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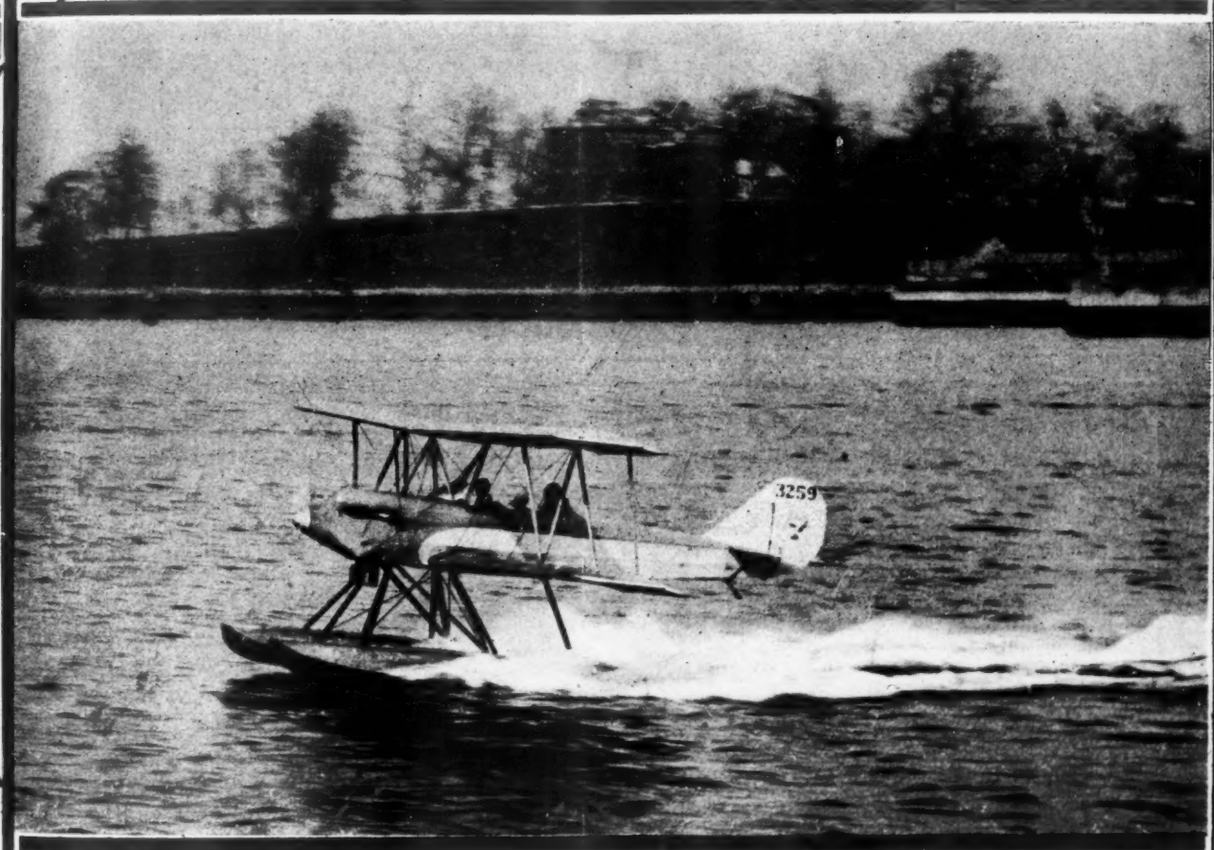
1928

AVIATION

The Oldest American Aeronautical Magazine

JANUARY 30, 1928 Issued Weekly PRICE 20 CENTS



An Alexander "Eaglerock" fitted with Edo pontoons getting off the water.

VOLUME XXIV

NUMBER 5

Special Features

The Zenith "Albatross"
Notes on the Guggenheim Safety Competition
Near Future Developments in Navy Aircraft Engines

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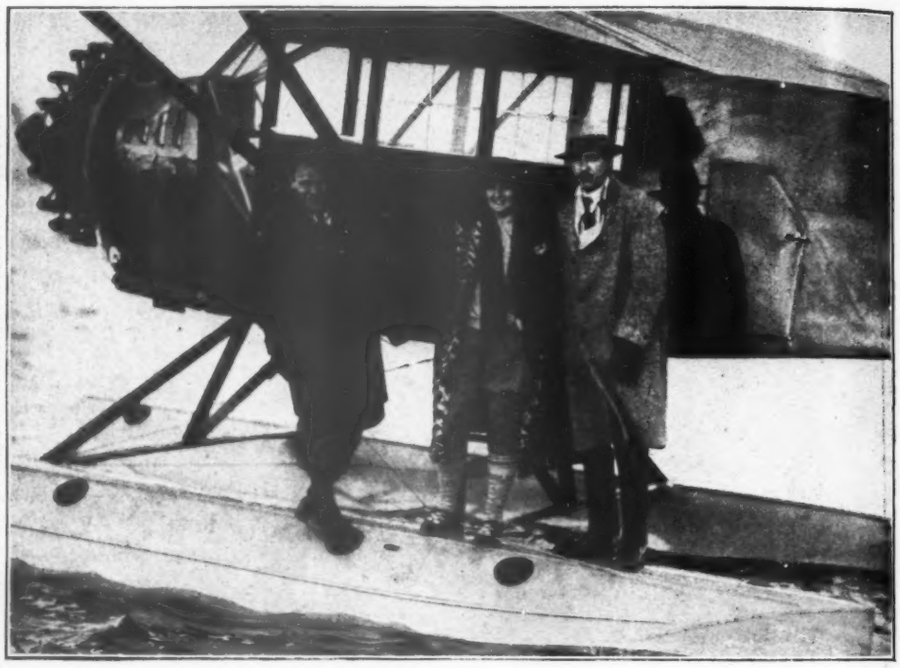
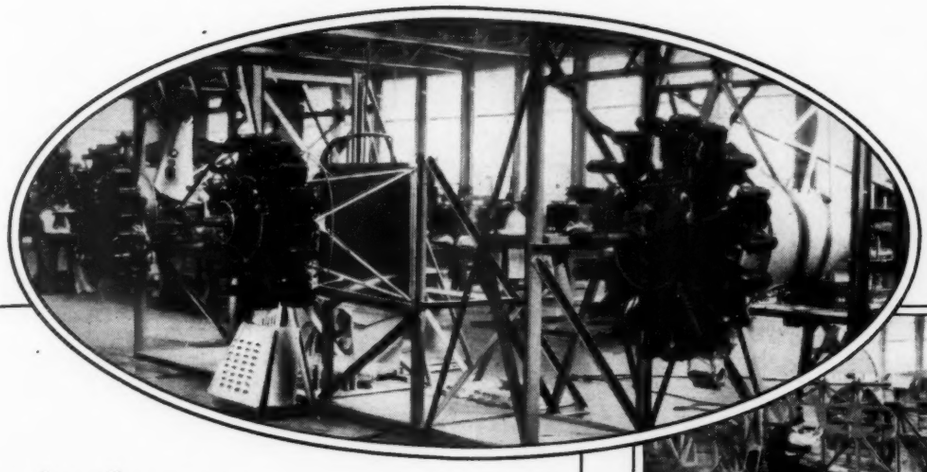


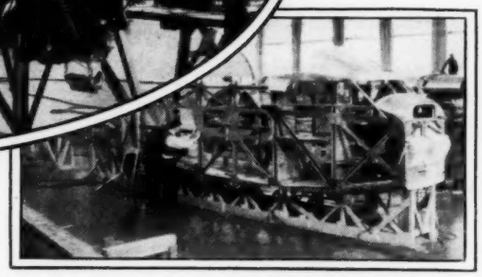
A REMARKABLE *tribute from Harry Rogers, international pilot and plane operator, whose telegram to Mr. Sherman M. Fairchild reads as follows:*

"The first nonstop flight from New York to Miami made by Ruth Nichols Major Lee and myself strengthens my conviction that you are producing the best commercial airplane on the market today *stop* With hundred and ninety-five gallons of gas luggage beaching gear and the three of us over nineteen hundred pounds of useful load the ship took off easily and landed perfectly Also twelve hundred fifty miles in twelve hours is something of a record for a seaplane We had enough gas left to go to Havana *stop* As a test before we left we took off with six passengers in addition to myself *stop* The monoplanes performance stability controllability and general flying qualities are exceptional The comfort with which the business man can now make long flights in an inclosed and heated cabin is a revelation to me after many years of flying in open cockpit airplanes *stop* Interest in the Fairchild cabin monoplane runs very high here and I hope that my second machine on order with you now will be speedily completed

HARRY ROGERS"

FA





In oval: *Motor mounting assembly line*
Below: *Frame of fuselage ready for covering*

Ford airplanes now built by continuous production methods

THE assembly line, interchangeable parts and uniform products now characterize the production of Ford all-metal, tri-motored, transport monoplanes.

Just as it was the first to apply that method to the manufacture of automobiles, the Ford Motor Company again is one of the first to apply the same ideas to airplane production. This pioneering is proving entirely successful.

From the receiving department at one end of the plant, where sheet duralumin and all rough stock enter, work progresses in a continuous process until the finished plane emerges at the other end, ready for test.

In addition to increasing production to keep pace with orders for Ford planes, this system offers a very definite benefit to future as well as present owners. For it assures the correct fit and easy installation of any replacement parts which may be required, thereby cutting down "out of service" time, and lowering mechanical up-keep costs.

The Stout Metal Airplane Co.
DIVISION OF FORD MOTOR COMPANY
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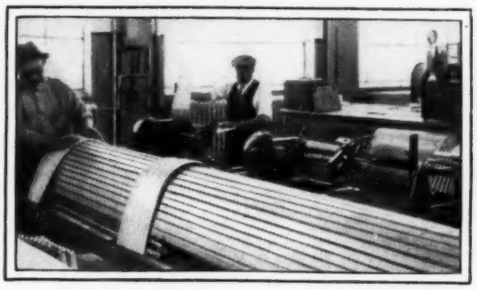
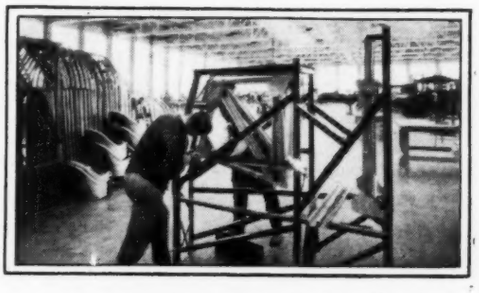
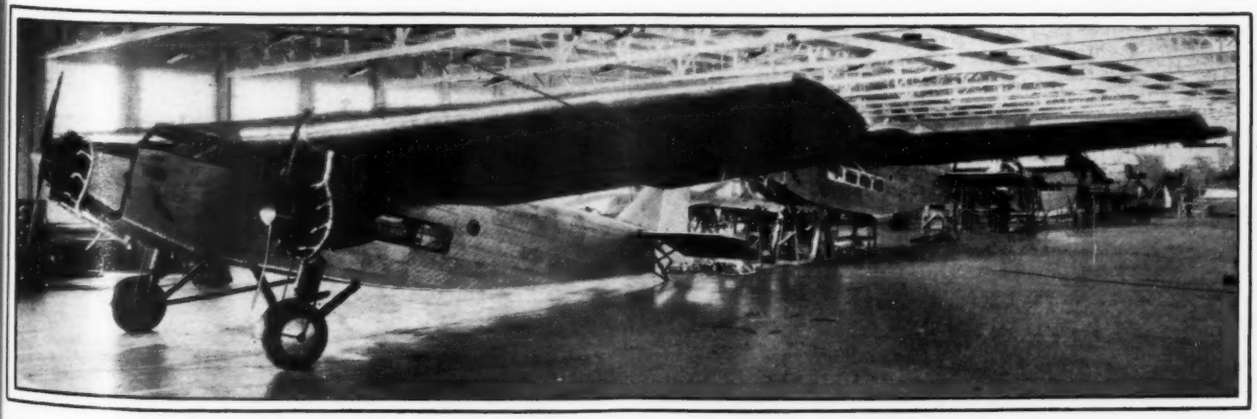


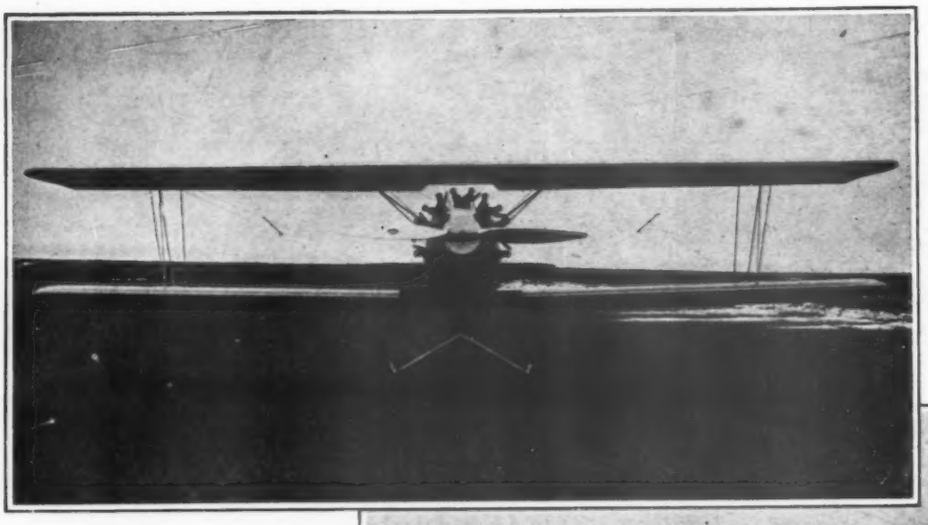
Fitting wing covering to a wooden form. All parts must conform exactly to the curvature of the form.



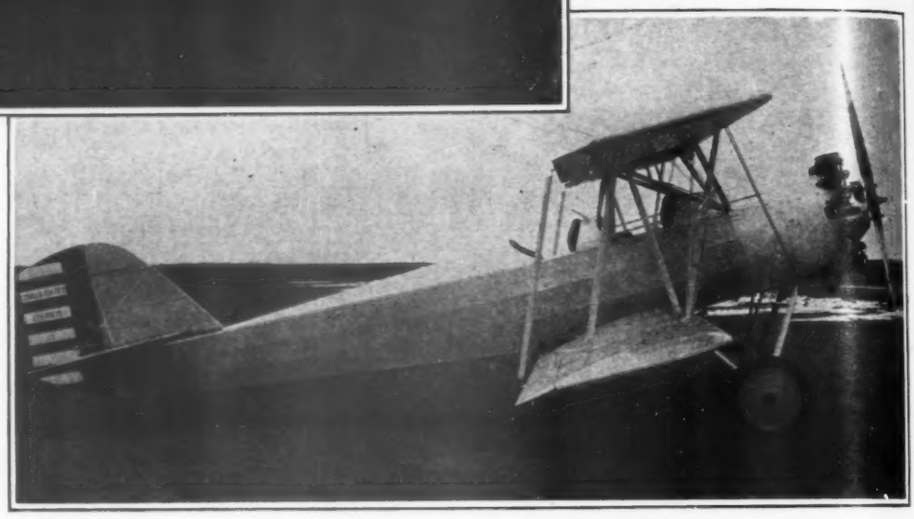
Assembling frame member in a jig. Pilot seats and completed frames at left.



End of assembly line. The plane in the foreground is completed and ready for its initial test



The Consolidated "Courier"



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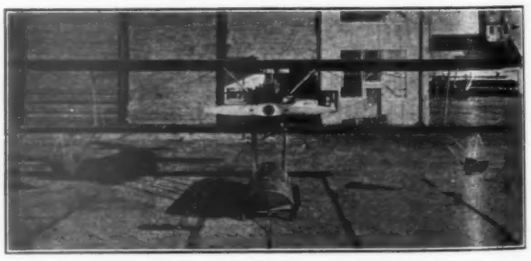

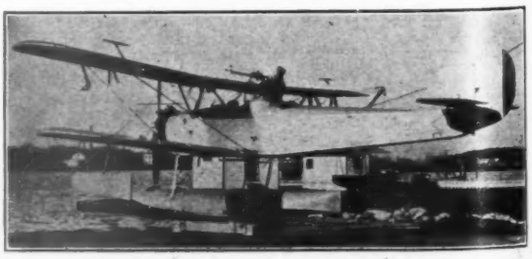

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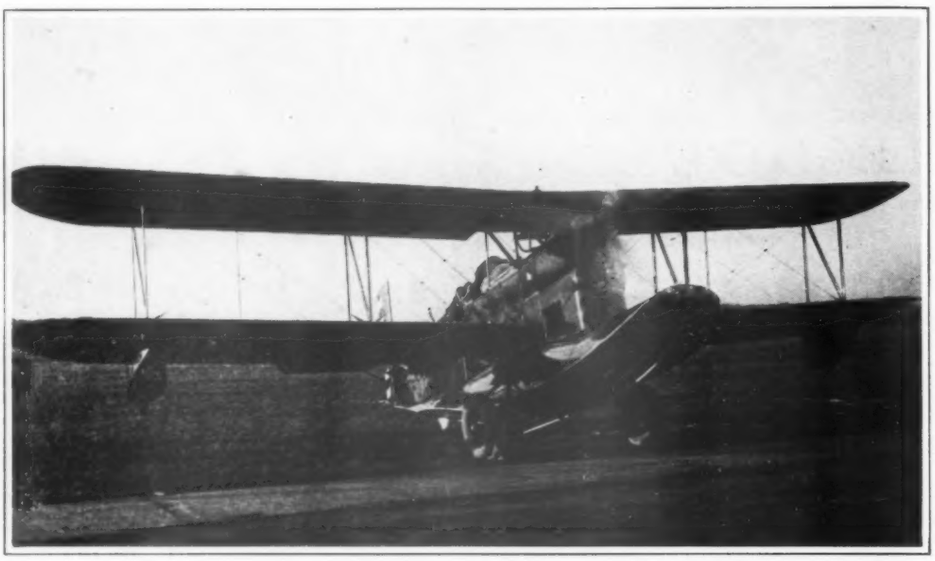

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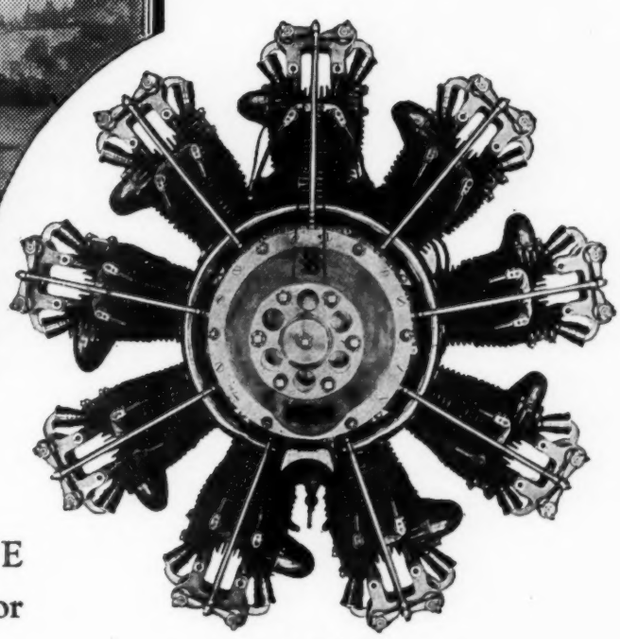

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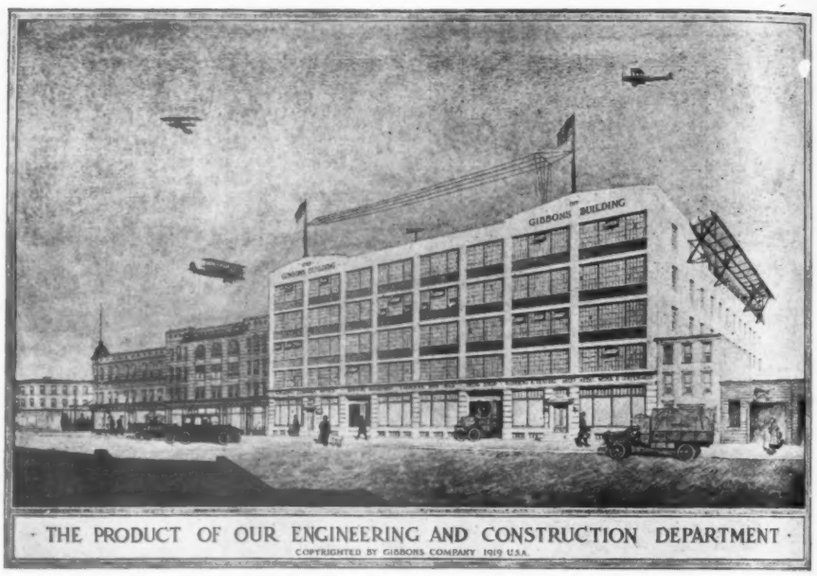
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Vol. XXIV January 30, 1928 No. 5

Index to Contents

EDITORIALS 245
NOTES ON GUGGENHEIM SAFETY COMPETITION 246
LOS ANGELES BUSINESS MEN DONATE $25,000 FOR NATIONAL AIR RACES 254
APPOINTED TO EAGLEROCK AGENCY FOR ENTIRE STATE OF MINNESOTA 254
NEAR FUTURE DEVELOPMENTS IN NAVY AIRCRAFT ENGINES 255
ALEXANDER MILBURN HAS LIGHT WEIGHT CUTTING AND WELDING TORCH 257
ORDER FOR SIXTY WACO-10 PLANES IS GIVEN BY RANKIN SCHOOL HEAD .. 257
THE ZENITH "ALBATROSS" 258
A-M-L-O LUBRICATING OIL 261
MARINES USE VOUGHT CORSAIRS FOR RESCUE WORK IN NICARAGUA 262
N.A.C.A. PUBLISHES TRANSLATIONS ON GERMAN GLIDER CONSTRUCTION 264
WACO PLANE DISTRIBUTORS DISCUSS 1928 PLANS IN MEETING AT TROY, O. .. 264
FISCHER AND JACOBS DEVELOPING SEVEN-CYLINDER RADIAL ENGINE 264
WICHITA'S SEVENTH PLANE COMPANY TO BEGIN PRODUCTION OF BIPLANES .. 264
PRICE OF ALEXANDER EAGLEROCK INCREASED TO $2750 ON FEB. 1..... 266
YOUNG EXPECTS PLANE PRODUCTION TO BE DOUBLE OR TRIPLE IN 1928 266
THE CORRECT WEIGHT OF THE NEW MILLER 130 HP. ENGINE IS 300 LB. 266
PACIFIC AIR TRANSPORT CONTROL ACQUIRED BY BOEING AIRPLANE CO. 268
THREE ENGINED FOKKER REMAINS IN AIR WITHIN THREE HOURS OF RECORD 268
ARKANSAS AIRCRAFT CO. TESTING PLANE DESIGNED BY VOELLMECKE 269
SIDE SLIPS 271
FOREIGN AERONAUTICAL NEWS 272
AIRPORTS AND AIRWAYS 274
UNITED STATES AIR FORCES 282

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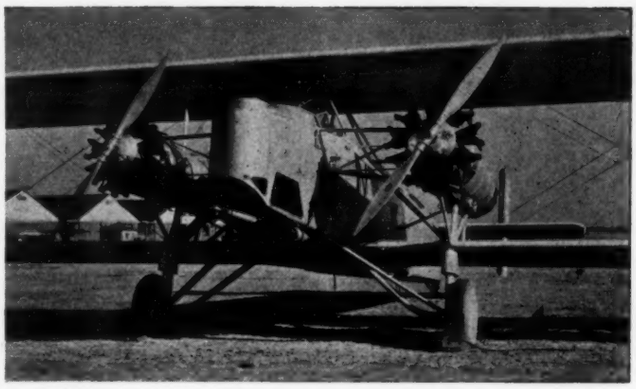

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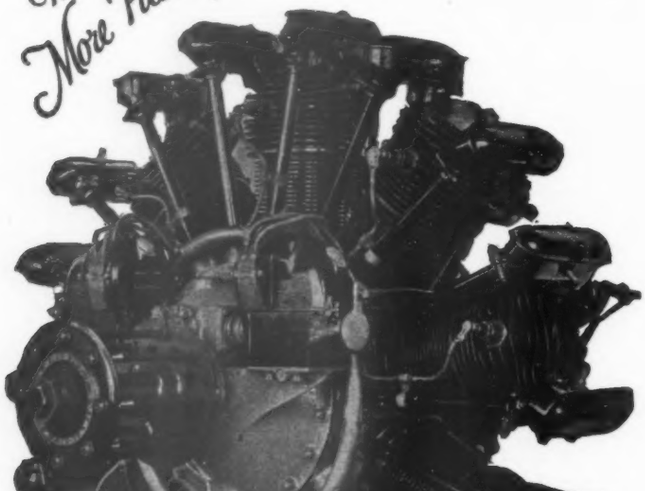

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AVIATION

The Oldest American Aeronautical Magazine

Vol. XXIV | *JANUARY* 30, 1928 | No. 5

The Reaction

THE FAILURE of many of the transoceanic flights has furnished a rallying point for certain reactionaries who claim that the airplane has never really progressed since it was invented by the Wrights, and that it never will progress to any appreciable degree. Such statements and arguments are put forward by some with entire sincerity, but with others the motive is entirely commercial. Every paper, be it a daily or monthly, tries to be somewhat different and original. The sentiment in favor of aeronautics has been so overwhelmingly strong that certain papers feel that they will attract attention to themselves if they take an opposite stand. The same is true of the writers as the market for stories and articles boosting flying is pretty well glutted, and the writer who brings out arguments against flying is following an original line which is more apt to receive attention.

Those who are familiar with what is going on in the aeronautical field are little influenced by reactionary articles, but the general public not knowing the facts is considerably influenced. In spite of all the publicity which aeronautics has received during the past year the public is still profoundly ignorant of the fundamentals of flying. Those who have the interest of aeronautical progress at heart should not relax in their efforts to educate the public. Flying meets, aeronautical expositions and lectures all help the cause and are worthy of support.

The Reason Why

THE QUESTION is sometimes asked as to the reason why AVIATION does not publish news accounts of various airplane accidents. To begin with, the reason is Not because of the fear that such publicity would be detrimental to the cause. Since its inception AVIATION has never attempted to conceal any information that would be of vital interest and importance to its readers. Nor will it attempt such a procedure in the future.

News accounts of airplane crashes are omitted from the columns of AVIATION because in a great number of crashes it is almost impossible to ascertain the direct cause, or causes, of the accident, and the major interest of such accounts to the person directly associated with the industry—the man to whom AVIATION caters primarily—is in the causes of the accident. The motive being accident research as a means of securing greater safety. However, the opinions of eye witnesses often differ considerably. This point was well illustrated by two accounts of a recent accident that were sent into this office. The details of each account were direct opposites to the other. And it is altogether possible that had we witnessed the crash ourselves we would have put forth a third opinion.

Therefore, in view of the facts, that, the real AVIATION reader interest in accident accounts is in the details of causes, which in many cases are impossible to discover, and that even the opinions of experts differ many times, and that it would be impossible for us to witness every airplane crash, why devote space to what must necessarily be considered as hearsay when there is so much other more important trade information available?

AVIATION is firm in the belief that by analyzing crash causes, progress can be made in the development of safer airplanes and safer flying. And AVIATION favors such an idea as the Department of Commerce, or some other reliable body, conducting investigations of airplane accidents to determine if possible whether the cause was structural failure or pilot carelessness, and we would most certainly publish the findings of the various investigation committees. But until such time comes —and it may be in the very near future—when crash cause information can be obtained from some such authoritative source we will refrain from giving space to airplane accidents as we do not feel that the ordinary news account of a crash is of sufficient value to our readers as to warrant its publication.

The 1928 Tour

A MOST IMPORTANT and altogether commendable arrangement planned for the 1928 National Reliability Tour is that of allowing the contesting planes to make two night stopovers at all the large cities visited. One of the main objectives of such tours has been to educate the public in the progress of airplane design and performance from year to year. However, in the three previous tours little time was allowed for the public to really inspect the planes, much less permit manufacturers' representatives to demonstrate their products to prospective dealers, or customers.

Under the new management the difficulty will be considerably reduced, and it behooves all manufacturers who enter planes to acquaint their dealers, at the various centers to be visited, with full details so that they in turn may make arrangements to have their prospective customers visit the local field while the Tour planes are there. If some of the contesting manufacturers are not represented by dealers at certain cities then the two night stopovers should prove most helpful in signing up logical prospects.

Notes *on the* Guggenheim Safety Competition

Minimum Performance Requirements

By ALEXANDER KLEMIN
Daniel Guggenheim School of Aeronautics, New York University
Assisted by OTTO LUNDE and B. DEMIDORF

The writer of this article is acting as one of the Technical Advisors in the Daniel Guggenheim Safe Aircraft Competition, and has been associated with the framing of the rules. The following notes must be taken however as purely an expression of his personal views.—ED.

The Basic Requirements

CONSTRUCTORS AND designers, before applying for entry in the Daniel Guggenheim Safe Aircraft Competition, will of course consider carefully the requirements to be met. The following notes may perhaps be of some interest in the consideration of the minimum performance requirements, which are as follows:

a. Minimum flying speed 35 m.p.h. b. Minimum gliding speed 38 m.p.h. c. Top speed of 110 m.p.h. d. Initial climb of 400 ft. a minute. e. Landing run of 100 ft. f. Approach over an obstruction 35 ft. high, and coming to rest 300 ft. from the base of the obstruction. g. Take off in 300 ft. h. Take off over an obstruction 35 ft. high in a distance of 500 ft. from base of obstruction. i. Flattest glide at 8° to the horizontal. j. Steepest glide at 16° to the horizontal.

Devices to Increase Maximum Lift

The speed range must be nearly 3 to 1 (110 m.p.h. top speed to 38 m.p.h. slow speed on the glide). It seems difficult to meet this requirement without the use of some device to increase the maximum lift of the airfoil, and it may be of interest to summarize the properties of as many such devices as possible.

a. Variable Area

By sliding back the lower portion of a wing, it should be possible to increase simultaneously the camber, incidence and area. The increase in maximum lift should be more than that obtained by increase in area alone. A machine on this principle, the Gastambide-Levasseur (1) has been built and flown.

Harlan D. Fowler, writing in AVIATION, (2) states that this machine equipped with a 250 hp. Salmson engine, with a gross weight of 3,100 lb., varied its area from 345 sq. ft., to 560 sq. ft., and had a speed range of 125 m.p.h. maximum to 37 m.p.h. landing. The Gastambide-Levasseur biplane had a variable area upper wing and a small fixed lower wing in which the ailerons were placed. This avoided the complication of aileron control in combination with the variable area mechanism. In a monoplane, if the variable surface is to run the whole length of the span, the lateral control will probably have to take the form of tip controllers, (as in Hill's Tailless airplane) of some form of auxiliary surfaces mounted above or below the wing, or of some form of front flap. In one Gastambide-Levasseur design, the chord was extended at the front as well at at the rear of the wing.

A variation of the same idea is found in the Bille Variable Surface Airplane, in which the rear portion of the wing telescopes in and out of a fixed front portion; with increased area and increased camber, a smooth contour is maintained (3).

Telescoping the wing, with a portion sliding in and out along the span, would have the advantage of increasing the aspect ratio and improving the climb, particularly as regards steepness of climb at slow speeds. Such an idea has been suggested by N. Carolin (4).

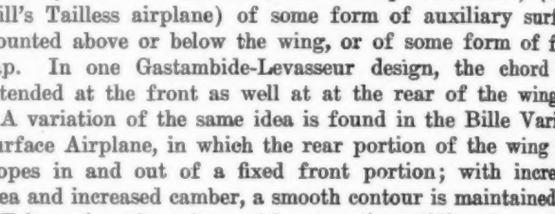


Fig. 1. Monoplane converted into a biplane at slow speeds.

Structural difficulties and control complications seem to have prevented the adoption of any variable area device thus far. The center of pressure movement with area extended would have to be carefully watched, although if the backward movement of the area were accompanied by an increase in the angle of incidence the movement of the center of pressure should remain within workable limits.

On the other hand we see no reason why a maximum lift coefficient Ky. of over .005 based on the original area should not be obtained.

b. Conversion of a Monoplane into a Biplane

Such an arrangement has recently been tested at Gottingen (5) and is shown in Fig. 1. The closed monoplane wing (of 100 cms. span and 20 cms. chord) had a maximum L/D of 15.6 and a maximum Ky of .00324 at 17.5° incidence. With the upper portion of the wing displaced till *a* was 8 cms. and *b* was 3.3 cms., the maximum Ky was .00605 at 21.1° incidence. With the combination opened up the L/D at high angles of attack is very low, which is valuable in se-

(1) *The Gastambide — Levasseur variables surface wing. The Aeroplane, Dec. 29, 1920; Another new wing, Aerial Age, Nov. 22, 1920.*
(2) *Means for Improving Airplane Performance, by Harlan D. Fowler,* AVIATION, *Dec. 5, 1921.*
(3) *The Bille Variable Surface Aeroplane, The Aeroplane, Nov. 15, 1922 and Scientific American, April 1923.*
(4) *Variable area and tandem wings,* AVIATION, *Jan. 16, 1922.*
(5) *Untersuchung eines Flugels mit geteiltem Profil. Ergebnisse der Aerodynamischen Versuchsanstalt Zu Göttingen, III Lieferung, page 99.*

curing a slow, steep glide. Aerodynamically the arrangement is therefore promising. It would seem however that the device would be complex in construction.

Similar tests by R. H. Hall (⁸) gave a maximum lift coefficient of only .00405, although the general effect was similar to those of the Gottingen experiments.

c. Variable Camber

It should be readily possible, theoretically, to start with a low lift symmetrical, double cambered wing section, with great efficiency at high speeds and to convert it into a heavily cambered, high lift wing. In experiments by Parker (⁷) in which such a change was effected by use of a pin jointed rib structure, as illustrated in Fig. 2, the ratio of maximum lift of section B was 108 times the minimum drag of section A; the maximum lift coefficient of B was .00384, and that of A .00214. The design was supposedly automatic in character, but there seemed no reason why the wing should assume any particular form when required, and vibration was to be feared. Many other forms of variable camber wings (⁹) have been suggested but in no case have designers apparently been able to overcome the basic structural difficulties involved.

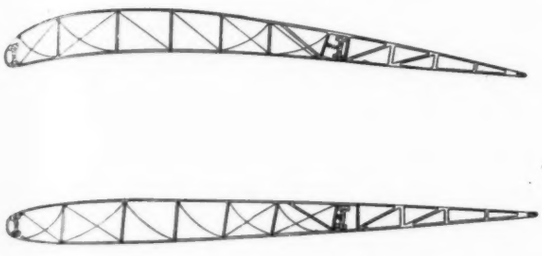


Fig. 2. Parker Variable Camber Wing.

In the Saint-Aubin glider (⁹) a single heavy box spar was employed towards the front of the thick wing (Gottingen 441). The front part of the ribs was fixed to the spar; the rear part of the ribs was hinged about a tube immediately behind the spar, and the cloth was applied in such fashion that the perimeter of the wing could be changed as the camber was mechanically varied.

Fig. 3. Burtenbach's Variable Camber Wing.

Burtenbach's patent (¹⁰), illustrated in the diagram of Fig. 3, shows a fixed front spar, and a movable rear spar, the device allowing the camber of the whole wing section to be diminished or increased by mechanical control.

d. Wragg airfoil arrangement; flaps partaking of the character of airfoils in tandem.

When a smaller airfoil suitably hinged is placed immediately behind the main airfoil, and its angle varied, the Ky of the wing can be varied as with a flap. While at least one Junkers machine has been equipped with such a tandem combination, comparatively little wind tunnel work has been done. The bulk of the experiments available is summarized in Table I. Reference to the work done at the Daniel Guggenheim School of Aeronautics on the Wragg Airfoil has been kindly permitted by Mr. Sherman M. Fairchild, of the Fairchild Aviation Co.; and by Mr. C. A. Wragg, on whose general idea the experimentation at New York University was based.

The small airfoil placed in tandem suffers by comparison with the ordinary rear flap insofar as its support involves greater structural difficulty and added air resistance. The exact position of the balanced rear airfoil is a matter of some delicacy. The percentage increases in lift are most marked when a basic airfoil of low minimum lift is selected. This opens up the possibility of using a double cambered "racing" airfoil which may be very efficient at high speeds. It will be noted from Table I, that by suitable disposing the rear flap, at Ky = .000537 [.0045 ÷ (required speed range of the competition)²], it is possible to improve the L/D as compared with the L/D of the basic wing at the same Ky.)

It is interesting to note that the Handley Page slot in combination with the Tandem airfoil produced an increase in Ky of over 106%.

The Wragg tandem airfoil has not been tested with flap depression greater than +23°. This is a serious gap in our information, which further tests at New York University may fill. The real value of the Wragg tandem airfoil lies in the fact that it is possible to obtain values of maximum Ky of well over .0045 with a moderate flap depression.

Fig. 4. A type of front slot recently tested at Gottingen.

e. Flaps and Slotted Rear Flaps

A great deal of work has been done on such flaps. As many experiments as possible have been summarized in Table 2.

For the unslotted flap it would appear that (a) depressing the flap, lowers the angle of attack of maximum Ky appreciably. (b) Depressing the flap lowers the L/D at maximum Ky appreciably, thus if the basic wing has an L/D of 9 at maximum Ky, the L/D with flap depressed 20° at maximum Ky, will be of the order of 6. This should facilitate steep gliding. (c) Depressing the rear flap through an angle of 20 degrees, gives an increase of maximum Ky of approximately 35% for a basic airfoil of low lift, and of approximately 20% for a basic airfoil of high lift. (d) There is a decided advantage in going well beyond 20° flap depression. With bold design of the flap control mechanism giving a flap depression of 45 deg. it should be possible to secure maximum Ky coefficients of .0045 and L/D at the same incidence of about 4. (e) Some improvement in efficiency at low lift coefficients, in the high speed region, is obtainable, especially for thick wings by turning the rear flap up through a few degrees.

The use of a front flap is of comparatively little interest. It is structurally more difficult to employ than the rear flap and has only a mediocre effect on the maximum Ky.

A McCook Field test (¹¹) is interesting because it gives an application of flaps to a biplane, the well known DH 4 with flaps running the whole length of the wing, and having a

(⁸) *Convertible Monoplane—Biplane Wings by Randolph H. Hall,* AVIATION, *April 26, 1926.*

(⁷) *The Parker Variable Camber Wing, by H. F. Parker, N.A.C.A. Report 77.*

(⁹) *"The touring airplane and the variable camber wing" by J. D. Hill,* AVIATION, *Oct. 1, 1920. Variable wing area and variable camber by H. B. Irving,* AVIATION, *Aug. 1, 1920.*

(⁹) *"Le Planeur de Saint-Aubin a courbure et incidence variables"* Aeronautique, *February 1923.*

(¹⁰) *German Patent 417250, H. S. Von Burtenback, Flugsport, March 8, 1926.*

(¹¹) *"Wing Flap Test of a DH-4B Wind Tunnel Model" by P. M. Lyons, Air Service Information Circular, No. 552.*

TABLE 1. EXPERIMENTAL RESULTS FOR FLAPS PARTAKING OF THE CHARACTER OF AIRFOILS IN TANDEM.

Reference	Basic Airfoil	Maximum camber of basic airfoil	Max. Ky and corresponding incidence for basic airfoil	Max. L/D and corresponding incidence for basic airfoil	Disposition of flap, slot, etc.	Max. Ky and corresponding incidence	Max. L/D and corresponding incidence	Disposition of flap, slot, etc.	Increase in Ky over basic airfoil	Improvement in L/D over basic airfoil at Ky=.000537	Description of tandem airfoil arrangement	SKETCH
Wind Tunnel Test No. 70, N.Y.U.	Wragg.	17.19% (Double Cambered)	.002641 15°	15.3 4°	Rear wing at +23°	.00476 10°-11°	14.0 2°	Rear wing at —1½°	80.3%	9.2 to 12.3 at —2.15° 38.7% Rear wing at 0°	Airfoil 18"x3". Rear wing 18"x1", ¼" below chord line.	Basic Airfoil Rear Airfoil
Wind Tunnel Test No. 81, N.Y.U.	Wragg.	17.19% (Double Cambered)	.002641 15°	15.3 4°	Slot open ¼" Rear wing at +23°	.00546 16°	10.12 —8°	Slot open ¼" Rear wing at +23°	10 . 5%		Same as above, but with extensible front slot.	Basic Airfoil Rear Airfoil
Wind Tunnel Test No. 83, N.Y.U.	Clark Y	11.7%	.00324 14°	16.6 2°	Rear wing at +23°	.0043 11°	16.6 0°	Rear wing at +1°	32.7%	8.6 to 11.4 at —2.4° 24.5% Rear wing at +5°	Airfoil 18"x3". Rear wing 18"x1", ⅛" below chord line.	Basic Airfoil Rear Airfoil
British R&M #886 Fig. 6-7		14.5%	.004003 16°	13.5 2½°	Rear wing Rear wing at +25°	.00588 14°	9.0 —4°	Rear wing at +25°. 0" gap.	46.9%		L. E. Rear wing .15" below T. E. main airfoil.	Basic Airfoil
Aero. Report #236 Aero. Lab. Wash., D. C.	Wragg.	16.35%	.00291 11°	10.6 5°	at +23° L. E. rear wing .05" below T. E. front wing	.00453 8.6°	10.05 6°	Rear wing at 0°, .27" below T. E. front wing. 0" gap.	54.0%	4.2 to 5.06 at —1.6° 20.5%	Airfoil 18"x3". Auxiliary 18"x1".	Basic Airfoil Axis of Rotation of Wing Negative angle of attack.
British R&M No. 804		5.88%	.00307 16°	13.2 4°	Front wing at —15° Rear wing at +24° .2" gap.	.004185	17.9	Front wing at —10°. Rear wing at +8° .2" gap.	36.3%	6.04 to 8.85 at 0° 46.6%	Two tandem airfoils practically identical.	Basic Airfoil Rear Airfoil Axis of Rotation of Wing Negative angle of attack.

chord 32% of the wing chord; a flap depression of 20° only increased the lift some 27%. Further depression of the flap produced no appreciable increase in lift. In the application of flaps to biplanes, disappointments may be in store for us, if very large flap movements are counted upon to give very high maximum Ky.

The slotted rear flaps show up invariably a little better than the unslotted rear flaps, from the point of view of maximum Ky. The rear slot, properly designed, has no detrimental effect on the L/D at high speed.

An interesting addition to our knowledge of the slotted rear flap is given by a recent Gottingen publication [12]. The underlying idea is similar to that of the Handley Page front slot; when the flap is depressed at high angles of attack a

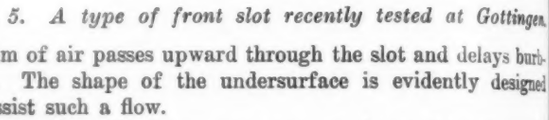


Fig. 5. A type of front slot recently tested at Gottingen.

stream of air passes upward through the slot and delays burbling. The shape of the undersurface is evidently designed to assist such a flow.

In the first Gottingen arrangement shown third from the bottom of Table 2, with flap raised —3°, maximum L/D was 17.4 and maximum Ky .00327 at 18.5° incidence. With the flap depressed to +37°, maximum Ky became .00466 at 15° incidence. With the flap depressed to +52° maximum Ky became .00485 at 13° incidence.

Starting with a thick double cambered airfoil of medium basic lift and of good efficiency, it is therefore possible to exceed .0045 for maximum Ky without too much flap depression, for a slotted flap design of this type, and L/D of 5 at maximum Ky should also be obtainable. The thick double cambered airfoil as in the Gottingen experiments has the further great advantage of having its maximum L/D at low value of Ky, that is in the high speed region.

f. Full Scale Effects on Flaps

Scale effects in connection with flaps have been the object of several experiments. Recent British tests [13], in which full flight values of lift and drag were compared with tun-

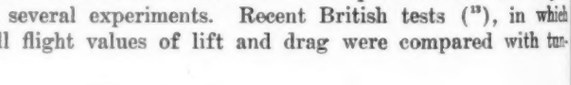


Fig. 6. Fixed auxiliary airfoil to produce higher maximum lift.

nel tests at various wind speeds, indicated that drag values are always slightly less at full scale. Values of maximum Ky with flaps depressed increase in the wind tunnel with greater wind speed, but drop at full scale. Thus for the Standard Bristol Fighter with a flap extending 35.5% of the wing chord, the following maximum Ky coefficients were obtained:

	Model LV			Full Scale
	19.3	28.9	43.3	
Standard Bristol Fighter	.00272	.00276	.00280	.00270
Flaps lowered 15.7°	.00325	.00330	.00339	.00328

At the same time it would appear that the fall off in maximum Ky with full scale is not of serious character.

g. Front Slots, and Front Slots in Combination with Rear Flaps

An extraordinary amount of experimental work has been

[12] *Untersuchungen an Flugeln mit Klappen und Spalt. Ergebnisse der Aerodynamischen Versuchsanstalt Zu Göttingen Lieferung III, page 111.*

[13] *Lift and drag of the Bristol Fighter with Fairey Variable Camber wings, by E. T. Jones, L. E. Caygill, R. G. Harris and H. M. Garner. British R. & M, No. 1085.*

done by the British, German and American laboratories, on the effect of front slots of various kinds, alone, and in combination with rear flaps, both slotted and unslotted. Results of some representative experiments are given in Table 3.

With the use of the front slot in combination with the rear flap, very powerful maximum lifts may be obtained, and the angle of maximum Ky becomes more reasonable than with the front slot alone. From the speed range point of view there is nothing as effective as the front slot and slotted rear flap used in conjunction, and a maximum Ky of .0050 is relatively easy to obtain.

The following table, compiled from Table 3, summarizes the average increases in maximum Ky obtained on thick, medium and thin sections, with the front slots alone, and with the front and rear slots in combination.

Type of Section	Average maximum camber	Average increase in max. Ky	Burbling angles of basic and slotted sections	Average change in maximum lift angle
EFFECT OF FRONT SLOT ALONE				
Thick	14.67%	35.8	15.8° to 24.25°	8.45°
Medium	12.1%	44.	12.91° to 20.25°	7.34°
Thin	7.2%	61.	14.12° to 25.1°	10.98°
EFFECT OF SLOTS AND FLAPS COMBINED				
Thick	15.1%	43.	16.67° to 22.34°	5.67°
Medium	12.1%	68.	12.91° to 13.75°	.84°
Thin	7.1%	75.	13.17° to 17.83°	4.66°

Lachmann has obtained an extraordinarily high lift value for a tapered thick wing, namely round .00725. The basic airfoil however was very inefficient, and it does not seem likely that designers will seek to achieve such very high lifts, since they connote inefficiency at high speed.

Some tests, more recent than those of Lachmann, with slots alone have been made at Gottingen ([14]). In this arrangement in Fig. 4, *b* was the position of the auxiliary airfoil in normal flight, and *c* in slow flight. In the arrangement of Fig. 5 where the auxiliary airfoil was swung about the hinge point D. For the first arrangement, the efficiency in normal flight was only fair with a maximum L/D of 13.6; with the slot swung into slow flight position the maximum Ky was .005 at 25.7° incidence, measured on the overall chord of the wing. In the second arrangement with the slot closed, the maximum L/D was 14.2; with the slot swung open the maximum Ky was .00432 at 25.6° incidence. None of the Gottingen tests look particularly promising.

Beside the disadvantage of the mechanism involved the front slot has a tendency to raise the angle of attack of maximum Ky, even with rear flap depressed, to somewhat higher values than the designer would like. This not only means a longer chassis, but also greater difficulty in lateral and longitudinal control. The combination of the Wragg tandem airfoil with the front slot, as shown in Table 1 seems to be a happy one. A maximum Ky of .00546 is obtained by the combination with an incidence of only 16 deg.

The front slot in conjunction with rear flap has this advantage (not indicated by the table) that the L/D falls off very rapidly beyond maximum Ky. This makes for steep gliding when required.

Another auxiliary airfoil device which has been tested in the Washington Navy Yard Wind Tunnel ([15]) is indicated in Fig. 6. Here the auxiliary airfoil was held in a fixed position. Results of tests have been disappointing, the increase in lift being only about 12 per cent. for the best setting tried, although the actual increase in area by the introduction of the auxiliary slot was 20 per cent. This does not mean however that some position for the auxiliary airfoil may not yet be found which will increase maximum lift, yet not diminish efficiency in normal flight.

([14]) *Ergebnisse de Aerodynamischen Versuchsanstalt Zu Göttingen, II Lieferung. Untersuchungen uber Tragflugel mit unterteiltem Profil.*

([15]) *Albatross Aerofoil with Superposed Small Plane, Aero Report 159 Washington Navy Yard Wind Tunnel, Aug. 10, 1920.*

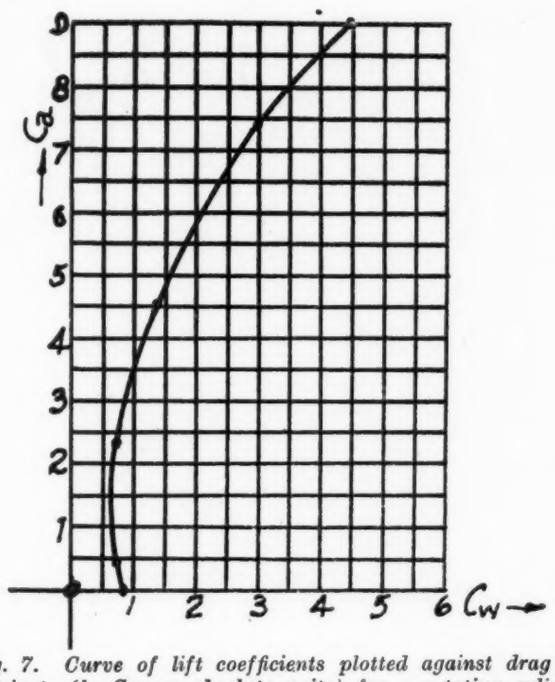


Fig. 7. Curve of lift coefficients plotted against drag coefficients (in Guman absolute units) for a rotating cylinder with end plates.

In a series of full flight experiments with the Bristol Fighter ([16]), a slot and flap aileron control was tested in conjunction with slots and flaps on the rest of the wing. With the main flaps down 15° and the ailerons down 10°, and all slots open, the maximum lift coefficient was .00435, an increase of 62 per cent. over the biplane value of .0027 of the basic R.A.F. 15 wing section. These tests are particularly valuable, because lateral control must be considered as well as the production of high lift, and it may not be advisable to depress the ailerons in flight as far as the center flap.

h. Scale effects on slots and flaps

For the designer, it is important to examine such data as are available regarding scale effect on slotted wings.

Full scale comparisons with wind tunnel tests have been made by the British ([17]) on a model of the Bristol Fighter, equipped with a small leading airfoil which when closed gave a good high speed section. In the case of the small leading airfoil, maximum Ky obtained in the tunnel was .00398; in full scale, .00378; and in both cases at 23° incidence. In the case of the large leading airfoil, maximum Ky in the tunnel was .00386, in full scale .00436; with incidences of 23° and 28° respectively. The model drag curves show slightly higher values at the same lift coefficient than the full scale tests. There is nothing disquieting for the designer in such meager scale effect data as are available.

i. Low Wing Ground Influence

With a monoplane placed one-half chord length above the ground the maximum L/D improves some 30 or 35%. There is therefore a certain advantage from the point of view of take-off run, with a low wing monoplane. The improvement in maximum lift is but very small, the maximum lift going up only 10 per cent., when the monoplane is one-fourth chord

([16]) *Preliminary Report on the Fitting of Slots and Flaps and Slots—and—Aileron Control to a Bristol Fighter, by H. L. Stevens British R and M No. 1088.*

([17]) *Model Measurements of Lift and Drag of Bristol Fighter with Handley Page Slotted Wing:—By E. T. Jones and L. E. Caygill, British R & M No. 1007.*

TABLE 2. FLAPS AND SLOTTED REAR FLAPS.

Reference	Basic Airfoil	Max. Camber % of Chord	Max. Ky and Corresponding Incidence	L/D at Ky Max.	Max. L/D and Corresponding Incidence	Max. Ky and Corresponding Incidence	L/D at Ky Max.	Disposition of Flaps	Max. L/D and Corresponding Incidence	Disposition of Flaps	% Inc. in Ky Max.	Improvement in L/D at Ky.= .00057	Disposition of Flaps	Description (Refer to sketch on next page with corresponding key letter.)
British Rep. & Mem. #152	R.A.F. 11	7.1%	.00238 14°	7.0	16.0 4.5°	.00371 3° .00368 4.5° .00322 10°	3.0 4.0 6.0	+60° +45° +20°	16.0 2.5°	+5°	56% 55% 35%	None		Flaps 37.5% of chord. (A) Across the whole span.
British Rep. & Mem. #152	R.A.F. 12	7.1%	.00235 13°	8.0	14.6 4°	.00376 4° .00369 6° .00325 10°	3.0 4.0 5.5	+60° +45° +20°	15.5 2°	+5°	60% 57% 38%	None		Same
British Rep. & Mem. #152	R.A.F. 13	8.5%	.00257 13.5°	9.0	15.9 3°	.00397 7° .00348 9°	4.2 6.0	+45° +20°	16.0 1°	+5°	55% 36%	None		Same
British Rep. & Mem. #648	R.A.F. 19	15.2%	.00397 12.5°	8.6	12.2 4°	.00476 12°	6.4	+20.7°			20%	None		Flaps 23% of chord. (B) Across the whole span.
S.A.E. Journal, Mar., 1921	Glenn-Martin 2	14.2%	.00400 18°	8.0	14.0 2.5°	.00520 12.5° .00448 15°	4.2 6.5	+55° +20°			30% 12%	5.2 to 7.4	—5°	Flaps 30% of chord. (C) Across the whole span.
Same	Glenn-Martin 4	15.4%	.00382 17.5°	8.5	13.4 1.5°	.00475 10° .00470 12° .00412 15°	4.1 5.0 6.5	+60° +45° +20°			24% 23% 5%	4.6 to 5.5	—5°	Same
N.A.C.A. Rep. #260	N.A.C.A. M-6	12.0%	.00337 19°	10.0	24.4 4°	.00440 17.5°	7.0	+25°			30%	None		Flaps 20% of chord. (D) Across the whole span.
British Rep. & Mem. #110	R.A.F. 9	7.3%	.00312 14°	9.5	16.2 3.5°	.00425 6° .00425 7° .00376 10°	3.3 4.0 6.5	+60° +45° +20°	16.4 2°	+2.5°	33% 33% 20.5%	7.4 to 9.3	—5°	Flaps 38.5% of chord. Across the whole span. (E)
Same	R.A.F. 9 Biplane Wing	7.3%	.00287 15°	7.5	13.4 4.0°	.00316 14°	6.0	+20°	16.4 2°		10%	None		Gap-chord=1.08. Same flaps as above on the upper wing only.
A.S.I.C. #552	DH-4 Biplane	5.8%	.00212 20°	2.2	7.3 5°	.00281 13.5° .00269 9°	2.3 3.7	+30° +20°	7.9 2°	—10°	32.5% 27%	7.1 to 7.8	+10°	Gap-chord=.65. Flaps 32% of chord across span, both wings.
British Rep. & Mem. #677	LV 30 (Albatross) Biplane Wing	6.9%	.00304 17°	7.0	13.1 4.5°	.00418 13° .00386 14°	4.0 5.0	+30° +20°	13.2 9°	—10°	37.5% 27%	5.9 to 9.6	—10°	Trailing flaps only used. (F)
Same	Same	6.9%	.00304 17°	7.0	13.1	.00440 15° .00403 16°	3.6 4.7	{ L.F.— 8° { T.F.+32° { L.F.— 8° { T.F.+20°	15.3 2.5°	{ L.F.+12° { T.F. 0°	45% 33%	5.9 to 13.0	{ L.F.+16° { T.F. 0°	Both flaps moved. Gap-chord=1 Flaps across the span. (F)
Same	LV 30 (Albatross) Monoplane Wing	6.9%	.00314 17°			.00453 .00439		{ L.F.— 9° { T.F.+40° { L.F.—10° { T.F.+30°			44% 40%			Same flaps on monoplane wing.
British Rep. & Mem. #865	R.A.F. 15	5.8%	.00267 14°	9.0	17.6 3°	.00323 12.5°	8.0	+10			22%			Handley Page slotted flaps across the span. Slots closed. (G)
Same	Same	5.8%	.00267 14°	9.0	17.6 3°	.00336 12°	6.8	+10	16.5 2.5°	0°	26%	13.1 to 11.8	0°	Same. Slots open.
Same	AD-1	7.9%	.00255 14.5°	7.0	18.2 4.5°	.00324 12.6°	6.5	+12°			27%			Handley Page slotted flaps across the span. Slots closed. (H)
Same	Same	7.9%	.00255 14.5°	7.0	18.2 4.5°	.00354 12°	6.5	+12°	18.0 4.5°	0°	39%	13.0 to 11.9	0°	Same. Slots open.
Wind Tunnel Test #49, N.Y.U.	Gott. 387	15.0%	.00362 14°	9.0	16.2 2°	.00437 16°	6.6	+20°	14.5 2.5°	0°	20.5%	8.0 to 5.7	0°	Bristol Freeze slotted flaps. 92% of span. (I)
Same	Same	15.0%	.00362 14°	9.0	16.2 2°	.00460 16°	5.2	+20°	12.4 4°	0°	27%	8.0 to 6.5	0°	Handley Page slotted flaps. 92% of span. (J)
Wind Tunnel Test #69, N.Y.U.	Clark Y	11.7%	.00324 14°	8.5	16.6 2°	.00388 12°	6.8	+20°	15.8 3°	0°	20%	9.0 to 10.0	0°	Slotted flaps 90% of span. (K)
Wind Tunnel Test #40, N.Y.U.	N.A.C.A. M6	12.0%	.00247 13°	9.0	13.6 6°	.00298 12°	7.5	+15°	12.3 6°	0°	20%	8.6 to 9.0	0°	Handley Page slotted flap across the span. (L)
Ergebn Aer. Vers. Gott. III	Special Profile	18.4%	.00327 18.5°	8.6	17.4 5	.00485 13° .00401 17°	5.9 6.9	+52° +17°			48% 22.5%	— to 14.5		Values given for basic airfoil correspond to a flap setting—3°. (Upper surf. continuous) (M)
Same	Same type	16.6%	.00378 17°	7.2	16.8 0°	.00491 11° .00485 13°	4.5 5.0	+61° +45°			30% 28.5%	—15.5		Values given for basic airfoil correspond to a flap setting +3° (N)
Same	Same type	14.3%	.00406 16.5°	6.3	14.6 1°	.00480 12.5°	4.5	+46°			18%	— to 15.5		Values given for basic airfoil correspond to a flap setting +2°. Same front part used in all exp. (O)

from the ground. The literature of the subject is extensive but somewhat contradictory ([18]).

j. Rotating cylinders and rotating cylinders in conjunction with airfoils.

The possibility of utilizing a rotating cylinder in a flying machine has been previously discussed by the writer ([19]). With a rotating cylinder the lift coefficient based on the projected area of the cylinder can be raised to very large values by sufficiently rapid rotation. This has led to the suggestion that a very small craft might be built to sustain a given gross weight. It has also been thought that slow speeds might be easily attained. From a curve given by Ackeret ([20]) (see Fig. 7) for a cylinder of 4-2/7 aspect ratio, protected by circular end plates of twice its own diameter, it would appear that the induced drag is not sufficiently reduced by the end plates, the profile drag is certainly large, and the efficiency is very low accordingly. The only way to increase efficiency would be to increase the aspect ratio by utilizing a long cylinder of small diameter. There would then be the difficulty that the cylinder would have to be spun at a tremendous rate of revolution to make the peripheral velocity two or three times the translational velocity (as necessary to secure good results) and the structure would be difficult to realize. The combination of a long narrow cylinder with large r.p.m. would make for a decidedly unpractical craft.

Quite a large number of experiments have been made with various combinations of rotating cylinder and airfoils([21]), the majority of which are listed below. The most promising are perhaps those described in Report A 105 of the Amsterdam laboratory. The two models tested are shown in Fig. 8, for which results are plotted in Fig. 9. From these curves it appears to obtain really powerful increase in lift ecoefficients, the rotating cylinder must not be shielded by a nose piece. When the cylinder is shielded, there is comparatively little effect because there is little of the cylinder's surface boosting the circulation of the air. With the model without nose piece, the maximum lift coefficient with the aid of the rotating cylinder is .00612 which is of course a very high value, higher than the majority of tests with slotted wings and flaps. Against this must be set the fact that with the cylinder at rest, the L/D of the combination becomes very poor. To utilize in practice the combination of an airfoil and a rotating cylinder would apparently mean the continuous turning of the cylinder at high speed. Unless very much better aerodynamic results are obtained on these lines, it does not seem worth while attempting full scale construction because of the obvious mechanical and structural difficulties involved.

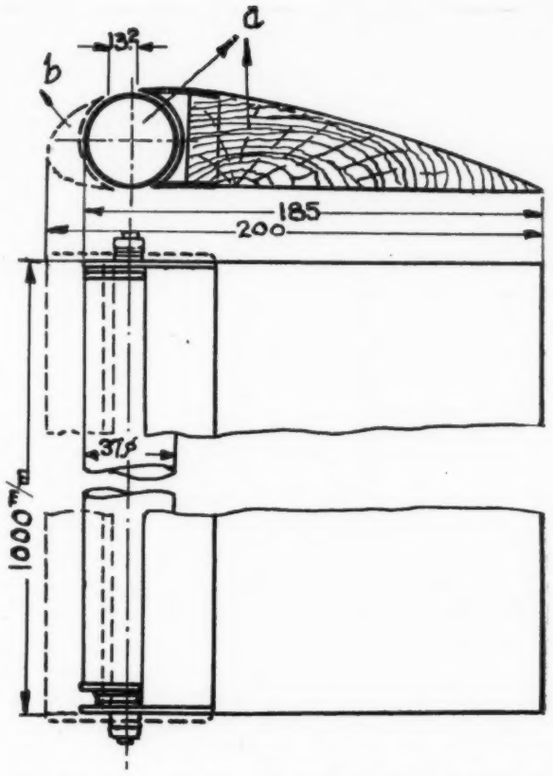


Fig. 8. Rotating cylinder and airfoil combinations tested at Amsterdam.

k. Prevention of Boundary Layer Detachment by artificial suction

In the case of the Handley Page or Lachmann slot, detachment of the air flow from the upper surface is prevented by the addition of kinetic energy to the upper air stream. This additional kinetic energy prevents the detachment of the boundary layer from the upper surface of the wing and the consequent formation of vortices. Another line of attack is to cause the air flow to follow the upper surface of the wing by applying artificial suction to this upper surface.

([18]) *"Cushioning Effect Aeroplanes close to the Ground" by W. L. Cowley and C. N. H. Lock, British R & M 754.*

"Wing Resistance near the Ground" by C. Wieselsberger, Zeitschrift fur Flugtechnik und Motorluftschiffahrt Heft 10, 1921.

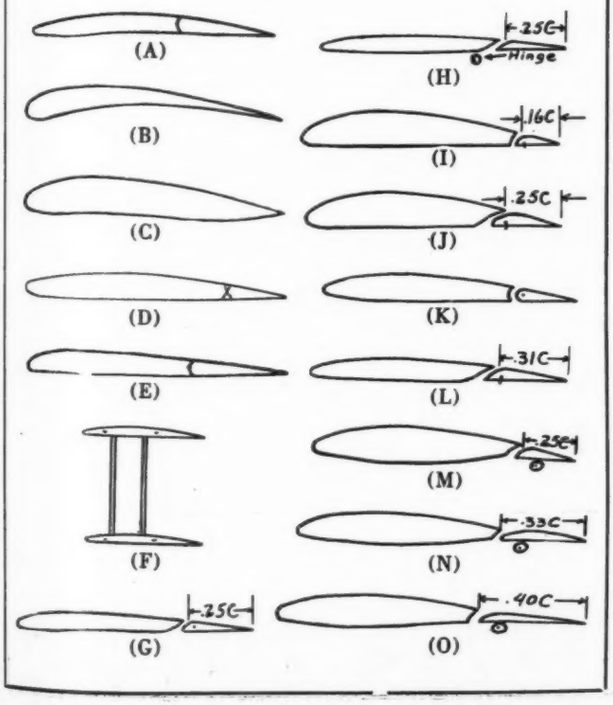
"Der Einfluss der Erdbodennahe auf den Flugelwiderstand" by L. Prandtl, C. Wieselsberger and A. Betz. Ergebnisse der Aerodynamischen Versuchsanstalt Zu Göttingen, Vol. 2.

"Ground Influence on Aerofoils" by Arthur E. Raymond, N.A.C.A. Technical Note No. 67.

([19]) *Can the Flettner Rotor be applied to Aircraft?* AVIATION, *Feb. 2, 1925.*

([20]) *Zeitschrift fur Flugtechnik und Motorluftschiffahrt, Feb. 14, 1925.*

SKETCHES FOR TABLE 2



([21]) *Versuche mit rotierenden Zylindern in Verbindung mit Tragflachen, Kurt Frey, Zeitschrift fur Flugtechnik und Motorluftschiffahrt, Aug. 28, 1926.*

Amsterdam, Report A105, Further experiments on the influence of a rotating cylinder accommodated in a wing section.

Amsterdam, Report A96, E. B. Wolf, Preliminary Investigation of the effect of a Rotating Cylinder in a Wing.

Amsterdam, Report A130, E. B. Wolf and C. Koning, Discussion of the Results of the Boundary-layer tests of an airfoil fitted with a Rotary cylinder.

Falk & Knack, unpublished thesis, Daniel Guggenheim School of Aeronautics, New York University.

De Bell & Lunde, unpublished thesis, Daniel Guggenheim School of Aeronautics, New York University.

TABLE 3. SUMMARY OF RESULTS ON AIRFOIL SECTIONS EQUIPPED WITH FRONT SLOTS AND REAR FLAPS.

Reference	Basic Airfoil	Maximum Camber of Basic Airfoil	Max. Ky and Corresponding Incidence for Basic Airfoil	Max. L/D and Corresponding Incidence for Basic Airfoil	Max. Ky and corresponding incidence	Disposition of Slots and Flaps	L/D at Max. Ky	Increase in Max. Ky over that of Basic Airfoil	Description	Sketch
Wind Tunnel Test No. 49B N. Y. U.	Gottingen 387	15.36%	.00366 16°	17.0 1.5°	.00433 at 16° .00428 at 19° .00505 at 17°-18°	Front slot closed. Flap down 20° Front slot open 0.334". Flap 0° Front slot open. Flap down 20°	5.11 7.0 5.46	18.3% 16.95% 38.0%	Main airfoil 25"x5". Handley Page front slot, and slotted rear flap. Flap 25% of chord.	
Wind Tunnel Test No. 40 N. Y. U.	N. A. C. A. M-6	12.01%	.00251 14°	14.3 4°	.00298 at 12° .003615 at 19° .00438 at 17°-18°	Front slot closed. Flap down 15° Front slot open. Flap at 0° Front slot open. Flap down 15°	7.55 5.92 5.53	18.73% 44.0% 73.2%	Main airfoil 25"x5". Handley Page front slot, and slotted rear flap. Flap 25% of chord.	
Wind Tunnel Test No. 69 N. Y. U.	Clark Y	11.7%	.00324 14°	16.6 2°	.00388 at 12° .00400 at 18½° .00486 at 18°	Front slot closed. Flap down 20° Front slot open. Flap 0° Front slot open. Flap down 20°	6.85 7.0 5.84	19.75% 23.45% 50%	Main airfoil 25"x5". Handley Page front slot. Flap not slotted. Flap 25% of chord.	
British R. & M. No. 835	R. A. F. 6	7.6%	.002808 13°	15.8 3.5°	.00433 22.5°	Front slot open .225"	7.0	54.2%	Airfoil with Handley Page front slot only.	
Flight Jan. 28, 1926	Handley Page A-1 (R.A.F. 15, Mod.)	7.54%	.00260 12¼°	18.5 2¼°	.00412 at 23° .00346 at 17° .00510 at 17½°	Front slot open. Flap 0° Front slot open. Flap 0° Both slots open. Flap 20°	6.0 9.05 6.31	58.5% 33.1% 96.2%	Main airfoil 36"x6". Extensible front slot, and slotted rear flap.	
British R. & M. No. 1007	Handley Page F-2-B	7.45%	.00275 18°		.00436 28°	Slot open.		58.5%	6.27" chord. Handley Page front slot only.	
Aeronautical Report No. 234. Navy Yard, Wash., D. C.	Original Handley Page	15%	(Both Slots Closed) .003989 17°	15.13 2°	.005388 at 28° .00649 at 30° .006649 at 29° At a=20°, Ky=.00529	Front slot open. Flap 0° Slots open. Flap down 20° Slots open. Flap down 30° Slots open. Flap down 20°	6.15 4.86 4.69 5.96	35.1% 62.8% 66.7% 32.7%	Has front auxiliary airfoil, and rear slot forward of rear flap.	
As above	Handley Page Airfoil B	15%	.003989 17°	15.13 2°	.004284 at 20° .005026 at 20°	Front slot closed above. Flap at 25° Both slots open. Flap at 25°	4.84 6.13	7.39% 26.0%	Same as above except rear slot is immediately in front of flap.	
British R. & M. No. 835	Airscrew 4	7.43%	.00377 17°	13.8 5°	.0051 at 18° .00541 at 22°	Both flots open, and flap down 20°		35.3% 43.5%	Has front extensible slot, and slot in rear flap to rear of hinge point.	
British R. & M. No. 929	R. A. F. 15	6.36%	.00260 12¼°	19.0 2°	.00383 at 20° .00454 at 27°	Slot open Slot open		47.3% 74.6%	Leading airfoil moves forward and down, and is capable of changing its angle. No rear slot.	
Z. F. M. May 26, 1924 (Lachmann)	R. A. F. 15	6.36%	.00260 12¼°	19.0 2°	.00485 14°	Front slot open. Slotted Ailerons.		86.5%	Handley Page front extensible slot. H. P. slotted ailerons.	
Z. F. M. Aug. 26, Sept. 26, '24 (Lachmann)	Tapered in Plan and Section	22.6% to 10.77%	.00444	12.35	.00725 .00742	Front slot open. Flap at 20° Front slot open. Flap at 30°	5.96 5.7	63.2% 67.1%	Has front extensible airfoil, and slotted rear flap.	
British R. & M. No. 1055	R. A. F. 31	12.7%	.00248 10¼°	18.5 —1¼°	.00411 at 23¼° .00452 at 15¼°	Front slot open. Flap 0° Front slot open .185". Flap 20°	6.0 5.09	65.7% 82.2%	Double cambered section with front extensible airfoil, and slotted rear flap.	
British R. & M. No. 1073	H. P. Slotted, upper (Biplane) F-2-B, lower		(With 2 F-2-B Wings) .0027 18½°		.00378 24½°	Top wings slotted	3.52	40%	Full scale Bristol fighter with slotted upper wings, and standard lower wings.	
Gottingen Vol. 2	Gottingen 398	13.7%	.003215 14½°	17.5 0°	.00500 25¼°	As shown in sketch	5.22	55.5%	Front auxiliary airfoil ahead of and slightly above main airfoil.	

ADDITIONAL REFERENCES:

Air Service Engineering Division Report No. 2708.
Study of slotted airfoils with and without flaps.
Flight, Dec., 1921. *Developments in aircraft design by the use of slotted wings.*
Paper before International Air Congress, by F. Handley Page, June, 1923. *The slotted wing.*
Aeronautical Journal, June, 1921. *The Handley Page wing.*
N.A.C.A. Circular No. 10 (1101-88), March, 1921. *The law relating to air currents.*
Zeitschrift für Flugtechnick und Motorluftschiffahrt, 31 Oct., 1921. *Problem of the slotted wing.*
Zeitschrift für Flugtechnick und Motorluftschiffhart, 15 June 1921.
Investigations of the Handley Page wing.

Schrenk has shown that the flow in back of a sphere can be improved by suitable application of suction ([22]). Ackeret, Betz and Schrenk have applied the same idea to an airfoil ([23]). A thick Joukowski airfoil, (see Fig. 10) was fastened at one end to a wall erected in the wind tunnel. The airfoil was

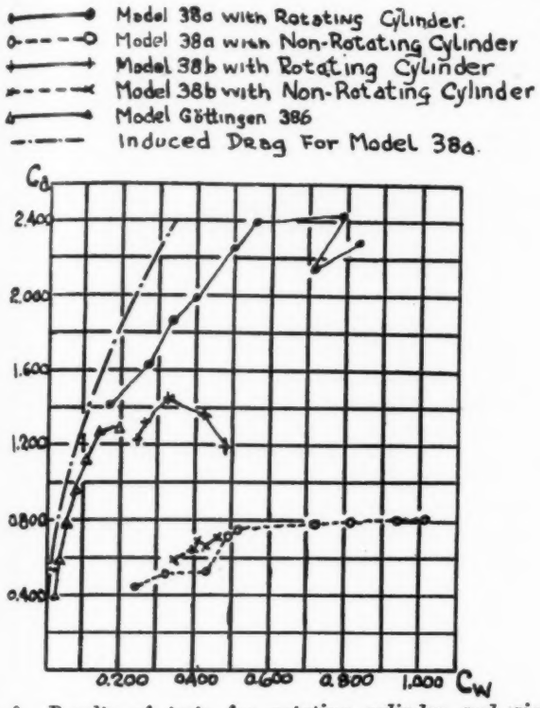


Fig. 9. Results of tests for rotating cylinder and airfoil combinations plotted in German absolute units.

divided into three compartments, 1, 2, 3 from which air was withdrawn, by the arrangement shown diagramatically in Fig. 11.

Measurements of the suction existing in each of the three chambers were obtained by tubes connected to a manometer. Apparently the upper surface of the wing had a large number of openings as indicated by the dotted line in Fig. 10. Pressure measurement over the upper surface of the wing were made with a special pressure meter which couuld be moved about from point to point. No force measurements could be made on the wind tunnel balance, but calculations were made from energy consideration. Two important results emerge. At a Ky value of round .002, the profile drag of the wing could be reduced to half its normal value, and even allowing for the energy used up in suction there was a distinct gain in drag decrease. Also the maximum Ky was made to reach a value of approximately .0140, at least three times ([24]) the value of the normal lift coefficient of the wing, though this was obtained only at an incidence of 45°.

Experiments on the effect of boundary layer, but with measurement of the actual lift and drag forces are now in preparation by two graduate students of the Daniel Guggenheim School of Aeronautics.

l. Ejection of Compressed Air to Prevent Burbling.

The use of compressed air, ejected at the upper surface of the wing to prevent burbling has been suggested by Mischl and Katzmayer of Vienna, and Baumann of Stuttgart. The theory back of the suggestion is that the energy of a stream of air coming out of the upper surface of the wing will prevent detachment of the air flow and eddy formation. The idea is similar to that underlying the Handley Page slot, and the application of suction to the boundary layer. For the experiments described by Seewald ([25]), the apparatus employed is shown diagramatically in Fig. 12. Unfortunately no data is provided on the amount of compressed air or power utilized, although it is feared that this will be considerable. The original wing gave a maximum Ky of .00394 at 20° incidence; the use of ejected air at 2, 3 and 4 atmospheres gave

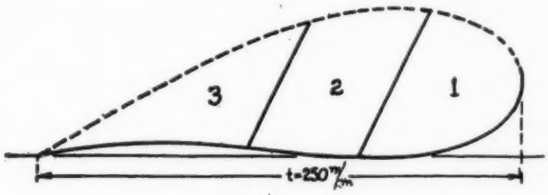


Fig. 10. Joukowski airfoil with slotted upper surface, used in experiments for prevention of boundary detachment by artificial suction.

maximum Ky values of .00665, .00765 and .00855 respectively. It can be said that ejection of compressed air can be made to realize extraordinarily high values, and that the research is worth pursuing further.

In another series of ejection experiments described by Wieland ([26]) five jets along the wing were used, (see Fig. 13) from which air could be expelled at great velocities, or through which air could be sucked at will. The results of these experiments are not promising. The only important lesson to be learned is that when the wing is held at a constant angle of attack, the ejection of air can be made to increase the lift indefinitely, as the speed of ejection increases. This is because an ejected stream increases the velocity above the wing as well as preventing air disturbances. When air sucked back through the jets, the lift does not increase with speed of suction beyond the point where a smooth flow is assured. The

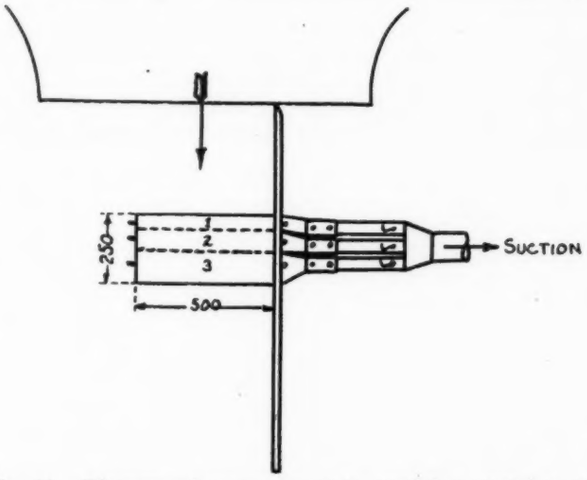


Fig. 11. Diagram of arrangement in applying suction to the boundary layer.

reaction of the ejected air also diminishes the total resistance of the wing.

m. Automatic Lift Increasing Devices.

For the practical designer, who keeps the difficulties of the pilot in mind, there is some interest in the automatic action of lift increasing devices.

([22]) *Versuche an einer Kugel mit Grenzschichtabsaugung, Oskar Schrenk. Zeitschrift fur Flugtechnik und Motorluftschiffahrt, Sept. 14, 1926.*

([23]) *Versuche an einem Flugel mit Grenzschichtabsaugung, J. Ackeret, A. Betz and O. Schrenk, Vorlaufige Mitteilungen der Aerodynamischen Versuchsanstalt Zu Göttingen.*

([24]) *Grenzschichtabsaugung, J. Ackeret, Zeitschrift des Vereines deutscher Ingenieure, No. 35, 1926.*

([25]) *Zeitschrift fur Flugtechnik und Motorluftschiffahrt, Aug. 16, 1927, Die Erhöhung des Auftriebs durch Ausblasen von Druckluft an der Saugseite eines Tragflugels, F. Seewald.*

([26]) *Untersuchungen an einem neuartigen Dusenflugel, K. Wieland, Zeitschrift fur Flugtechnik und Motorluftschiffahrt, Aug. 16, 1927.*

Handley Page is experimenting with front auxiliary slots which open automatically when the incidence of the airfoil reaches something like 11 degrees, and a region of concentrated suction appears at the upper surface of the wing at the leading edge.

The Parker Variable Camber wing was designed to be purely automatic in action, but there is no particular reason why the wing should assume any particular camber at different flight speeds.

In the Fairey Variable Camber ([27]) device the flaps employed are like normal ailerons, except that they extend over the whole span of the wing. When the machine is at rest the flaps are held down at an angle of approximately 15 degrees to the normal high speed position by a stiff spring. With increasing speed, and backward movement of the center of pressure, the trailing flap gradually rises. The action is thus purely automatic. The De Havilland company reports that the attitude of the machine changes very little with speed variation, that landing speed is decreased, and that the steepness of the climb is increased by the use of the flaps.

Review of High Lift Devices

The following conclusions as to the various high lift devices can only be regarded as tentative.

(a) Rear flaps, preferably slotted, if pushed to the logical limit so that they can be depressed to large angles can be

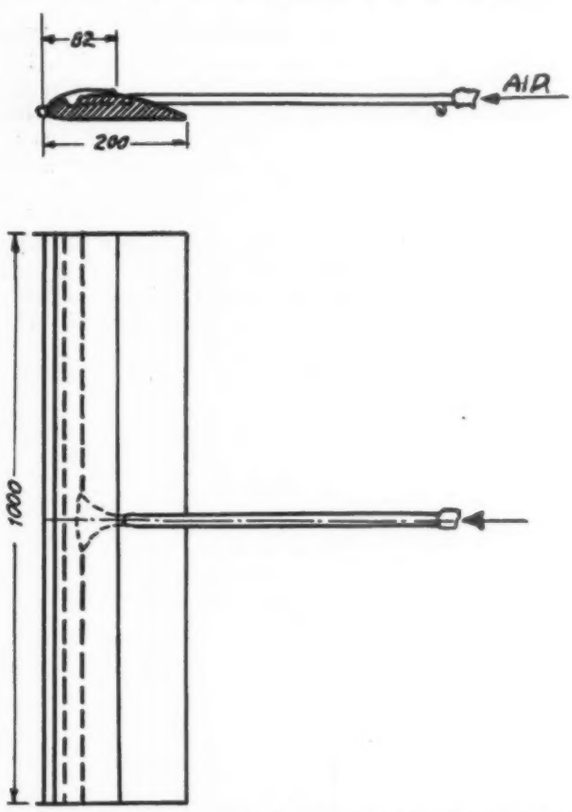


Fig. 12. Diagram of arrangement used by Seewald in ejecting air under pressure to the boundary layer.

made to give maximum Ky values of .0045, with good efficiency at high speed.

(b) The Wragg type tandem airfoil can be made to secure maximum Ky values of .0045 without excessive flap depression. The structural difficulties will be somewhat greater than in the case of the simple rear flap.

(c) The Handley Page front slot in conjunction with the rear slotted flap can be made to increase maximum lift powerfully, beyond Ky = .005. The disadvantage lies in the complication and in the high angles of attack at which maximum Ky is secured. The combination of the Wragg tandem airfoil with the front slot seems promising.

(d) Variable camber does not seem worth considering.

(e) Variable area per se does not seem a promising line of attack. Variable area devices which are so arranged as

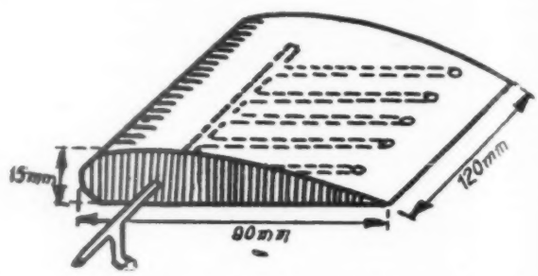


Fig. 13. Diagram for ejection experiments by Wieland.

to increase the camber simultaneously with the area, should be as powerful as regards increasing maximum Ky as the front and rear flaps. If the mechanical difficulties can be overcome, variable area should be worth considering.

(f) Rotating cylinders however arranged are not within the realm of practical possibilities.

(g) Air ejection is likely to involve prohibitive power losses.

(h) Removal of the boundary layer by suction is an extremely powerful line of attack and deserves intensive study.

Continued in Next Week's Issue

([27]) *The De Havilland Automatic Flap Gear, The Aeroplane, April 30, 1924, also* AVIATION *June 9, 1924.*

Los Angeles Business Men Donate $25,000 For National Air Races

INTEREST IN bringing the National Air Races to Southern California in 1928 was well displayed during a meeting of the National Aeronautic Association held recently at the Ambassador hotel, when Los Angeles business men subscribed more than $25,000 toward the cash prizes to be awarded.

One of the greatest factors concerned with bringing the races to this section during the fall of 1928 is that the greatest concentration of army and naval aircraft ever witnessed in this country will take place it is said, at that time when the two aircraft carriers, Saratoga and Langley, join the Pacific fleet for fall maneuvers.

It was also considered of importance that the first aviation meet in the world was staged at Dominguez Hill, Southern California, in 1911, that much of the pioneer experimenting was done in this vicinity, and also that 1928 is the twenty-fifth anniversity of the first flight of a heavier than air machine.

More than twenty eight concerns contributed to the prize fund. Among them were the Douglas Co. of Santa Monica, American Aircraft Corp., Rogers Airport, Maddux Airlines, Inc., Bach Aircraft, Inc., The Aero Corp. of Calif., Burdette Air Lines, Inc., L. A. Airways, and California Airways.

Appointed to Eaglerock Agency For Entire State of Minnesota

THE MINNESOTA Aircraft Company, 406-6th Ave., Minneapolis, Minn., has been added to the Alexander Aircraft Company's list of distributors, and has been allotted the entire state of Minnesota.

Near Future Developments *in* Navy Aircraft Engines

By LIEUT. COMDR. J. M. SHOEMAKER, U.S.N.

Head of the Engine Section, Bureau of Aeronautics, Navy Department.

UP TO the present year, the efforts of air cooled engine manufacturers have been directed mainly toward attaining the utmost in reliability. Air cooled engine installations have inherent weight advantages, due not only to their construction, but also to the elimination of radiators, water lines, pump and water.

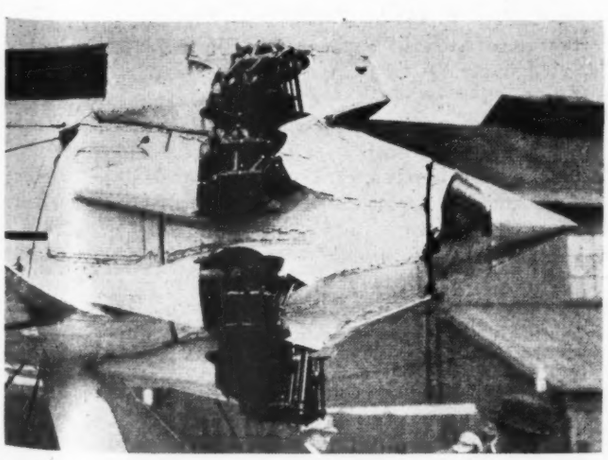
Although engine failures due to cooling system defects are automatically eliminated, it remained for the remarkable flights of 1927 to prove that air cooled engines are at least the equal of water cooled engines as regards reliability, and in all conditions of weather and temperature.

Having gained the confidence of the world in their products, American manufacturers of air cooled engines are taking steps toward refining and improving them. In addition to possible radical changes in engine design, improvement in present engines may be expected along the lines of stepping up the horsepower and reducing the specific fuel consumption. These improvements are possible due to:

(a) The soundness of design of the present engines, and their undoubted ability to stand higher loads.

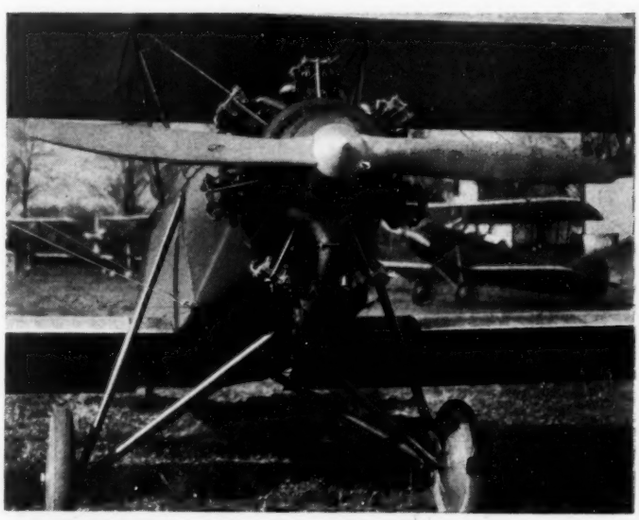
(b) Availability of greatly improved aviation gasoline.

Paralleling the development of high-test motor fuels, the development of Ethyl Fluid, and its extensive use since 1925, has greatly improved the anti-knock qualities of domestic aviation gasoline. This has made possible the successful operation of modern engines on eastern (paraffin base) fuels whose natural anti-knock characteristics are extremely poor. If Ethyl Fluid could be used in any concentration, engine compression ratios might be raised to almost double that of present engines without regard to the natural anti-detonating qualities of domestic aviation gasoline. Unfortunately, however, excessive use of Ethyl Fluid has a very deleterious effect on valves and valve seats.



A Bristol "Mercury" installed in the Short racing seaplane "Crusader". Note the "helmet" in place on the top cylinder and the distance between the engine and the propeller.

It has always been possible to write gasoline specifications which, by requiring a certain critical temperature of solution with analine, automatically shut out gasoline distilled from paraffin base crudes. This requirement, however, is not in conformity with the Federal Specifications Board specification for aviation gasoline. The Federal Specifications for gasoline as revised this year allow the military services to establish an acceptable list of approved aviation gasolines based on samples submitted for test. This will enable the Navy to establish a standard anti-knock value which must be equalled by any gasoline before it is placed on the acceptable list. Several large oil companies have been conducting extensive experiments with a view to producing a domestic aviation gasoline with high anti-knock characteristics, and these fuels will be ready to meet the Navy's requirements in the near future.



A Waco 10 powered with a 100 hp. seven cylinder Siemens-Halske engine.

The means employed for increasing the power output of the Navy's present engines may be:

(a) Increase the R.P.M.,

(b) Increase the compression ratios,

(c) Supercharge.

The first step in this direction should be to increase R.P.M. and employ maximum allowable compression ratios with full throttle, sea-level operation. On top of this, engines may be supercharged to give rated power at full throttle at a predetermined altitude. This will necessitate the use of a throttle stop to limit throttle opening until a safe altitude is reached. The rotary induction sysem of fuel distribution

now in use in modern radial engines lends itself beautifully to supercharging, as all that is required to obtain almost any desired manifold pressure at sea level is a change of impeller gear ratio.

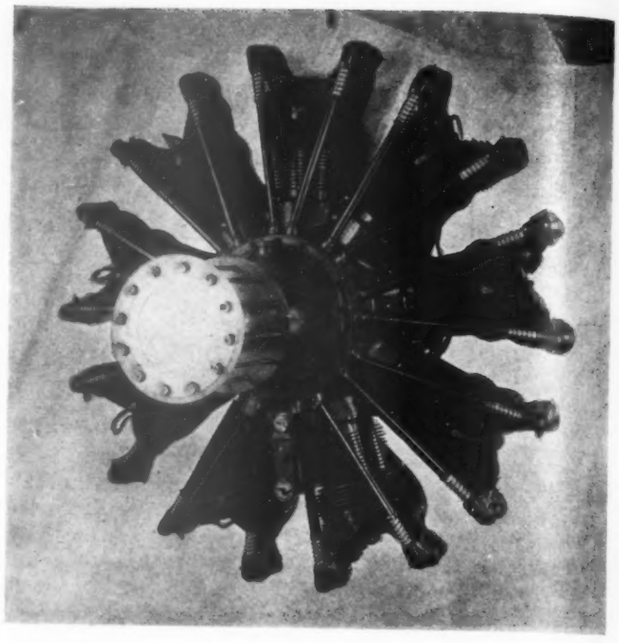
The extent to which a service engine can be gradually stepped up in power is best exemplified by the British Bristol Jupiter engine series. All of these engines are nine-cylinder, static radial, air cooled, direct drive. The following table illustrates this:

	Jupiter Series IV	*Jupiter Series VI*	*Mercury*	*Wright Cyclone*	*Pratt & Whitney Hornet*
Year	1924	1926	1927	1927	1927
Bore	5.75″	5.75″	5.75	6.00	6.125
Stroke	7.5″	7.5″	6.5	6.875	6.375
Piston Displacement, cu. in.	1755	1755	1520	1753	1690
R.p.m.	1720	1870	2250	1900	1900
Hp.	430	480 520	870	540	538
Compression Ratio	4.9:1	5.3:1 6.3:1	8:1 (?)	5.36:1	5.0:1
Oil Consumption Lb./b.hp./hr.	.039	.030	?	.025	.025
Oil used	Castrol	Castor	Castor	Mineral	Mineral
Fuel used	20% benzol	30-38% benzol	?	D.A.G.	D.A.G. + 2. c.c. Ethyl Fluid/Gal.
Weight, dry, lb.	812	730 735	673	765	749
Overall Diameter	55″	53″ 53″	49″	54″	54.5″

The above table is a striking illustration of successive increases in the output of the same basic engine. The increase of power in the Jupiter VI over the Jupiter IV is due mainly to the higher compression ratio and higher r.p.m. The 6.3:1 compression ratio Jupiter VI is intended for altitude work. This engine incorporates a throttle stop, and full throttle is not used below 5000 ft. altitude. The Bristol Mercury engine is a redesign of the Jupiter, with particular attention paid to reduction of diameter, and with a geared supercharger incorporated.

The two columns on the right give the general characteristics of the two large-displacement American radial engines. Both of these engines have built-in rotary induction systems.

A Pratt & Whitney "Wasp" engine installed in the Wright "Apache" plane.



Front quarter view of the 525 hp. Pratt & Whitney "Hornet" engine.

A comparison of the American engines with the British ones would seem to indicate that either the Cyclone or the Hornet is capable of having its output increased considerably by the means previously discussed.

It is worthy of note that the Jupiter engines require fuel with a high benzol equivalent, and must be lubricated with castor oil. American engine designers have been handicapped in comparison with the British by the insistence of the Navy (the Cyclone and Hornet were both designed for the Bureau of Aeronautics) on the use of relatively low-test (paraffin base) aviation gasoline, and of mineral oil. As outlined earlier in this paper, expected improvement in the quality of fuel will remove the first of these restrictions. The use of mineral oil will still be required, however, in spite of the somewhat superior qualities of castor, because the supply of castor oil in quantity cannot be depended upon. In connection with a comparison of these British and American engines, the Jupiter engines require a separate oil cooler in the return line to the oil tank from the scavenger pump. The two American engines do not require oil coolers, thereby greatly simplifying engine installations.

Speed Too High for Good Propeller Efficiency

It is noted from the table that the Mercury engine develops its rated power at 2250 r.p.m. This is entirely too high for good propeller efficiency except on airplanes of extremely high speed, for which the Mercury engine is intended. Raising the crankshaft speed is a comparatively simple means of obtaining more horsepower, however, provided the propeller shaft is geared down to a point which will give a good propeller efficiency with a reasonable propeller diameter. It is understood that the Jupiter Series VIII engine incorporates a 2:1 reduction gear, and this probably means that the crankshaft speed has been raised. Both the Hornet and the Cyclone have been experimentally fitted with reduction gears, which may become standard for these engines when used in comparatively slow, heavy duty planes.

The designers of the Hornet and the Cyclone concentrated on obtaining the desired power with engines of the utmost reliability and the minimum possible weight, and they brought out engines which, while extremely satisfactory as airplane power plants, do not lend themselves to streamlining as well

as they might. The two means by which power plant resistance in a fuselage may be reduced irrespective of the type of cowling employed are:

(a) A reduction in engine frontal area;
(b) Increase in the longitudinal distance between the propeller hub and the maximum engine diameter.

The diameter of the Jupiter VI is two inches less than that of the Jupiter IV. This has been accomplished by shortening the cylinders, shortening the connecting rods, and reducing the diameter of the crankcase while retaining the same stroke. The diameter of the Mercury is four inches less than that of the Jupiter VI, which reduction is due to the one inch shorter stroke plus redesign of valve operating gear. It is probable that the diameters of the Hornet and Cyclone could be reduced in somewhat the same manner.

Geared Radials Automatically Lengthened

Redesigning the crankshaft of a radial engine to get the propeller hub farther in front of the engine would seem to present fewer difficulties than that of reduction in engine diameter. There is very little difference in this respect between the Jupiter IV and VI, but particular attention was paid to this feature in the design of the Mercury, in which the front cover of the crankcase was lengthened and tapered. Geared radial engines are automatically lengthened by the inclusion of the usual concentric gearing in the front crankcase cover.

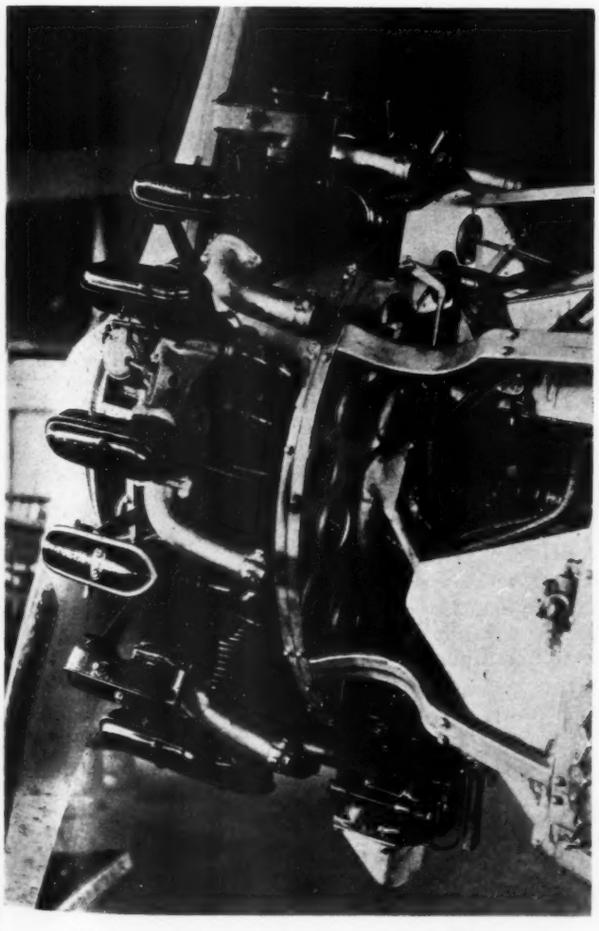
The idea of building engines to fit airplanes, as discussed above, is one that will, it is hoped, influence American engine design during the next year. A further step, and a seemingly logical one, is to call upon engine manufacturers to supply with the engines a suitable exhaust manifold and suitable engine nose cowling. The design of both of these engine fittings is extremely important in assuring successful power plant operation, and it will be distinctly to the advantage of engine manufacturers to control such design. Heretofore in this country, both the engine cowling and the exhaust manifolding have been provided by the airplane manufacturers.

The results of attempts to cowl radial engines by airplane designers have been in many cases none too good. There is as much chance of undercowling an air cooled engine as of overcowling it, and in addition the cowling should be adjustable in the air for various temperature conditions. The engine manufacturers know the operating temperatures at which their engines run best, and how the cylinders can best be cowled.

The provision of exhaust manifolds by engine instead of airplane manufacturers should be a marked improvement, as engine manufacturers are vitally interested in insuring that the exhaust manifolds used with their product not only do not build up back pressure, but are an integral and serviceable part of the power plant assembly.

Radial air cooled engines are not, necessarily the last word in aircraft power plants. They have, however, reached a high state of development. Their adoption for all Naval airplanes as well as their general use commercially, is due to the widespread confidence in their reliability and ease of maintenance coupled with the great saving in power plant weight that they make possible. The soundness of design of present radial engines insures the possibility of increasing their power with no increase in weight and no decrease in reliability.

In conclusion, I would like to emphasize again the two thoughts that prompted this article. They are: "More power to the radial engine;" and "Build engines to fit airplanes."



Wright Whirlwind Engine on Columbia.

Alexander Milburn Co. Has Light Weight Cutting and Welding Torch

OF INTEREST in aviation manufacture is a new light weight combination cutting and welding torch developed by the Alexander Milburn Co., Baltimore, Md. The Milburn Type RI, as it is called, promises fine work in the welding of steel fuselages and in wing construction.

The new tool cuts or welds with the mere interchange of tips and is made to operate with either oxygen and acetylene, oxygen and hydrogen, or other gases. The use of two torches or the necessity of disconnecting the hose from the torch valves when a change from cutting to welding, or vice versa, is made, is no longer necessary. The torch weighs but 40 ounces, yet it is equally efficient on lights or heavy metals and will cut upwards of 12 in. in thickness.

But two gas tubes rather than three are used in the tool. Other features are the high pressure oxygen thumb button which may be fixed in either open or closed position at will and the forged bronze torch head and valves having a tensile strength of 60,000 lb. per sq. in. Without harm the nose of the torch may be put into molten metal or burned.

Order For Sixty Waco-10 Planes Is Given By Rankin School Head

WHILE IN the East to attend the recent air congress in Washington, D. C., Tex Rankin, head of the Rankin School of Flying, Spokane, Wash., placed an order for 60 Waco-10 biplanes at the Troy, O., factory for immediate delivery. Three of the planes have already been sold to Nick Mamer, Spokane, Wash., Waco dealer.

The first flight of the "Albatross" at Midway City Airport, Santa Ana, Calif.

The Zenith "Albatross"

New Large Parasol Monoplane Powered With Three 125 Hp. Siemens-Halske Engines Performs Well During Tests

THE ZENITH "Albatross", manufactured by the Zenith Aircraft Corp., Santa Ana, Calif., and said to be the largest parasol type monoplane ever constructed, has made three test flights with a total duration of more than nine hours and has flown so satisfactorily that the designers, Charles F. Rocheville and Albin K. Peterson, are well satisfied with its performance.

This plane has a semi-cantilever, externally braced wing of 90 ft. spread and is designed to carry 14 passengers and baggage at a maximum speed of 100 m.p.h. with a total rated horsepower of only 375. Because of the fact that it is designed to fly on approximately half the power used by other planes of this size, many persons have scoffed at the ability of the plane to fly at all.

In the recent tests the plane showed most remarkable flying qualities, taking off in still air within 150 ft. and landing at a speed of 25 m.p.h. with a run of approximately 300 ft. These tests were made with two pilots, 175 gal. of gasoline and 30 gal. of oil. The Albatross climbed 2000 ft. in four minutes, flew at a speed of 95 m.p.h. and throttled down to a slow speed of 30 m.p.h. Both Mr. Rocheville and Mr. Peterson, who are former Navy men, say that the plane handled beautifully and is superior in ease of control to the latest type of twin engined bomber. This plane floats nicely and an altitude of 20,000 ft. is expected to be an easy performance for it.

The design of the Albatross was started some months ago by Mr. Rocheville and Mr. Peterson while both were still in the Navy. Mr. Rocheville had built four monoplanes and one biplane of the high efficiency type and Mr. Peterson had built a low horspower monoplane of very good performance. The two men got together and found that their ideas on design were similar, both of them seeking to get away from high horsepower and to build for lightness without sacrificing strength.

The design of the Albatross was completed while these men were still in the Naval Air Service and it was not until some time in August that the Zenith Aircraft Corp. was formed with Sterling Price, of Santa Ana, as president. The capitalization of this company is $200,000 and it is a closed corporation, all financing being cared for by the immediate backers with no prospect of increased capitalization or public offerings of stock unless orders placed should demand immediate expansion in which case it would be necessary to call in outside capital.

Tested at Midway City Airport

Following the organization of the Zenith Aircraft Corp. the designers of the plane obtained a furlough from the government service, gathered an expert group of workmen about them and started construction in a hangar and factory at Midway City, near Santa Ana, on a sixty acre tract of land owned by Mr. Price. This sixty acre field has been named Midway City Airport and commercial flying is now in progress there, the field being approximately 2,000 by 1,200 ft.

The Albatross was completed in less than 90 days and it is

stated that the factory is now equipped to produce one of these planes each month. It is planned that additional equipment, buildings and personnel will soon increase the plant capacity to one plane per week.

In the future the Zenith factory plans to produce three models, all of the same general characteristics as the Albatross and all powered with Ryan-Siemens engines as standard equipment. The planes to be produced will be three, six and twelve place, with the twelve place plane as the chief product.

Plan to Make Endurance Flight

Plans for the Albatross call for full load tests at North Island, San Diego, which will probably be completed before this goes to press, and an attempt on the world's endurance record for sustained flight will be made as soon after as weather conditions permit. For the endurance flight the Albatross carries a 900 gal. gasoline tank in the main cabin and wing tanks with a capacity of 400 gal. It is thought that the Albatross will easily pass the sixty hour mark.

Charles F. Rocheville and Albin K. Peterson will be co-pilots on the endurance flight with W. L. Shields as radio operator and relief pilot. Mr. Rocheville was chief mechanic on the Byrd-MacMillan expedition and on the Ben Wyatt Alaskan survey expedition. Mr. Peterson was the official photographer on the Alaskan Survey.

Following the attempt on the world's endurance record the factory plans to commence production on the Albatross type, tentative orders for several of these planes being already on hand.

The excellent performance of the Albatross type is due to an intensive effort to produce a plane that will fly on low power. A very careful lightening of the structure has been made everywhere and the greatest care has been taken to obtain maximum efficiency from wing and propellers.

The Albatross has a wing spread of 90 ft. The chord of the wing is 12 ft. both at the root and tip. The wing tips are built up with light wood ribs and steel tube fairing. The leading edge is fabric over dural from the spar forward. The wing is semi-cantilever, a center plate over the cabin making left and right spars integral. The spar itself is box type, 14 in. by 3 in., with ⅛ in. plywood plates on the outside. In addition there is a built up Warren truss inside, of 1¾ in. by 2¾ in. spruce members. Each spar weighs 140 lb., the total spar weight being 560 lb. Front and rear spars are identical.

Gottingen 398 Wing Section Used

The wing curve is a modified Gottingen 398. The wing ribs are spaced ten inches apart, have a maximum depth of 19 in., weigh 1¾ lb. each and will each support a load of 510 lb.

The ailerons are spruce construction with cable and internal horn operation, and are carried on a false spar by piano hinges. They are of shielded type with an area of 24 sq. ft. each.

The compression members between the wing ribs are steel tube and heavy ribs. The drag bracing is single wire. The total weight of the wing is 1300 lb. and the total wing area is 1032 sq. ft. The full wing loading when carrying a maximum load of 13,000 lb., will be 13 lb. to the square foot. The wing is attached to the fuselage at the cabin with four fittings, while two struts on each side extend down parallel to each other from wing to lower longeron fittings.

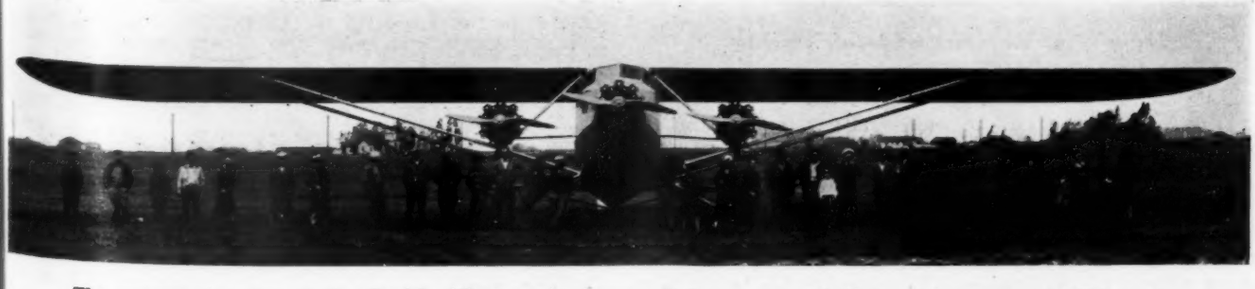
Albin K. Peterson (left) and Charles F. Rocheville, designers of the Albatross.

The fuselage complete with fittings weighs 700 lb. Welded steel tubing in Warren truss structure is used throughout. Fuselage tubing being one and one half inch 18 gauge to one inch 20 gauge, all tubing lacquered outside, with oil and varnish inside, to prevent corrosion.

The length of the plane is 50 ft. overall and the height is 12½ ft.

The fin is adjustable on the ground only and has an area of 6½ sq. ft. The horizontal stabilizer is adjustable in flight and has an area of 70 sq. ft. The rudder is balanced and has an area of 18 sq. ft. Total flipper area is 34 sq. ft. All tail members are constructed of steel tubing.

The fuselage streamlining is accomplished with light steel tube outline form and spruce fairing to carry the fabric.



The comparative size of the Zenith Albatross is shown. It has a span of 90 ft. and an area of 1032 sq. ft.

The fabric is light weight Flightex stitched to the wing ribs at three inch intervals.

The landing gear has a tread of 18 ft. and is constructed of heat treated steel tubing with 36 in. by 8 in. wheels. The shock struts are Aerol type FC-4 which extend to the fitting on the main forward wing strut just below the outboard nacelle.

Each engine nacelle complete weighs 575 lb. and is covered with duralumin on forward section and fabric over rear section. Each is supported from wing spars by two struts to the forward spar and one strut to the rear spar. Additional struts run to each main support below the nacelle and a strut which carries the controls extends horizontally from the fuselage to the nacelle structure.

The staff of the Zenith Aircraft Corp.

The three nine cylinder Ryan-Siemens engines rated 125 hp. each are so installed that superchargers may be added without any change in fittings, room being allowed in nacelles and nose mounts. The oil tanks are carried for each engine directly behind the space reserved for superchargers should they be installed.

Engine control is by positive coupled rods. Fuel is fed by gravity from wing tanks, a pump supplying the wing tanks with fuel from the main tank in cabin. Fittings are provided so that fuel may be sent from any tank to any engine. The fuel tanks are 28 gauge, terneplate steel.

The wing of the Albatross before covering.

The pilot's seats have been placed ahead of and slightly above the main gasoline tank. There is an emergency exit door on the right side of the pilot's cabin and one in the roof of the cabin. The main entry door is on the left side about midway of the fuselage. Two comfortable berths have been installed on top of the fuel tank and an aisle along the center of the tank provides easy movement between front and rear of cabin. The dimensions of the main cabin are 5 ft. 2 in. wide, 7 ft. high and 14 ft. long.

Forward cabin windows are plate glass and rear are heavy isinglass. All control surfaces are horn and cable operated with wires running over pulleys from a Deperdussin control.

The propellers used on the Albatross are of wood construction built by C. S. Story of Glendale, Calif., are 7 ft. 8 in. in diameter and of 7 ft. 6 in. pitch.

The Albatross has been issued experimental license number X-3622, by Capt. Walter Parkin, aircraft inspector of the Department of Commerce.

This plane has a maximum power loading of 29 lb. per hp. and a maximum wing loading of 13 lb. per sq. ft.

Preliminary flight tests have indicated that the Albatross will be of very high efficiency when compared with any previous plane of similar size. In tests conducted with the plane light it has shown the ability to fly successfully on only the center engine and it performs nicely on any two engines.

Perspective view of the Zenith Albatross.

The manufacturer's specifications of the Zenith Albatross are as follows:

Length	50 ft.
Span	90 ft.
Chord	12 ft.
Height	12 ft. 6 in.
Airfoil	Modified Gottingen 398
Wing area	1032 sq. ft.
Aileron area (each)	24 sq. ft.
Fin area	6½ sq. ft.
Stabilizer area	70 sq. ft.
Rudder area	18 sq. ft.
Total area of elevators	34 sq. ft.
Wt. of plane (light)	4000 lb.
Wt. of wing	1300 lb.
Wt. of fuselage (complete with fittings)	700 lb.
Shock absorber	Aerol type FC-4
Wing loading (13,000 lb. load)	13 lb. per sq. ft.
Power loading	29 lb. per hp.
Engines	3 nine cyl. Ryan-Siemens 125 hp.
Fuel capacity	1300 gal.
Oil capacity	120 gal.
(Actual performance with two pilots, 175 gal. of gasoline and 30 gal. of oil.)	
Landing speed	25 m.p.h.
High speed	95 m.p.h.
Low speed	30 m.p.h.
Climb	2000 ft. in 4 min.
Estimated performance with full commercial load.	
Take off	600 ft.
Landing speed	35 m.p.h.
High speed	100 m.p.h.
Cruising speed	85-90 m.p.h.
Ceiling	above 20,000 ft.

A-M-L-O Lubricating Oil

New Product Has All Advantages of Coming From Pure Paraffin Base Crude Oil and is 100 Per Cent. Wax Free

By F. D. BOSTOPH

Sales Manager, Texas Pacific Coal And Oil Co.

DURING THE late war, when Texas was coming to be known as "the land of flying" it was also gaining recognition as a "land of oil", for at that time the prospectors of the drill were realizing their dreams with producing oil wells that have since made the Texas oil fields famous. Therefore it is perhaps only fitting that Fort Worth, Texas, should be the home of what is believed to be the first lubricating oil developed especially for aircraft engines.

The men who are responsible for the development of the new oil, which will be known as "A-M-L-O" (Aviation Motor Lubricating Oil) worked for several years to produce the lubricant. They frankly disregarded the possibility of ever marketing A-M-L-O for automobile or tractor use. As this oil was pre-destined for use only in aircraft engines, certain standards of perfection were set.

Can be Used in All Weather

To begin with the Texas Pacific Coal and Oil Co., developer and marketer of A-M-L-O, recognized the fact that paraffin base oils are better lubricants for aircraft engines than oils refined from crudes of asphalt or napthene base. Although this fact has long been recognized by many of the leading lubricating engineers, the successful use of paraffin base oils has heretofore been restricted to the warmer seasons. In colder weather it has been necessary to sacrifice the better lubricating qualities of the paraffin oil and substitute asphalt or napthene base oils for their greater fluidity. From this knowledge it is evident that the ideal aircraft lubricant is one refined from a high grade paraffin base crude oil and made 100 per cent. wax-free so that it can be used with perfect safety in even zero weather.

Ideal Lubricant 100 Per Cent. Wax Free

Several years ago the technical staff of the company set out to develop such an all weather, aircraft lubricant. The manufacturers recognized the fact that little would be accomplished by merely lowering the wax residue. The issue before them was to entirely eliminate all wax. Wax has no lubricating value, and serves no good purpose in an internal combustion engine. It is also a dilutent lowering the viscosity of an oil at the operating temperature of the engine. For a long time many paraffin base oils which contain only a small amount of wax have been on the market; but even an oil having a pour test as low as 16 F contains approximately 1½ per cent. wax and is not safe for use in cold weather. What the officials of the company consider as a perfect aircraft engine lubricant could not become a reality until a me-

Partial view of Texas Pacific Coal and Oil Co's refinery in Fort Worth, Tex.

thod was devised to make paraffin base lubricating oil of paramount quality 100 per cent. wax-free.

It was also recognized that the best lubricants are those that contain the hydrocarbons in an uninterrupted chain. Most oils are blended products, made by mixing light and heavy oils. But the ideal oil should be blended. It must be a direct still product, run directly from the stills so that the hydrocarbons would be in their natural state.

The Texas Pacific Coal and Oil Co. was particularly well fitted to undertake this important task. To begin with it has its own oil wells which product the world recognized 100 per cent. Pure Paraffin Base Ranger Crude. This oil is carefully gathered by an exclusive pipeline system and brought to the refinery uncontaminated by other crude oils. The refinery which handles only this one crude oil is of the most modern design in the country with special equipment not found elsewhere.

Special Equipment Installed

Before the research work had been under way long, it was discovered that additional new testing and refining equipment were necessary to produce a wax-free oil suited for the most severe service known, i.e. aircraft engine lubrication. It was necessary to invent special devices, build and install them before the work could continue to its successful completion. Long after the last piece of this special equipment began operation, the company announced the perfection of A-M-L-O which the company's officials consider meets or exceeds every required specification for an engine lubricant; has all the advantages of coming from pure paraffin base crude oil and is 100 per cent. wax-free.

Performance tests have proved that A-M-L-O can be used during all seasons in all temperature conditions; and that it forms an instant film over all moving parts at starting temperatures, regardless of the weather. Because of these properties, together with its high viscosity and exceptional purity, those who have put it to every test state that it lasts a third longer than any other oil they have ever used. For these and other reasons, those in the position to know have predicted that A-M-L-O will revolutionize aircraft lubrication.

Marines Use Vought Corsairs For Rescue Work in Nicaragua

WITH THE delivery of a number of Vought "Corsair" planes to the Marine Corps operating in Nicaragua, the Marine Aviation Unit there, under the command of Major R. E. Rowell, has become one of the most effective weapons against the rebels. These high-performance planes, the entire November production of the Chance Vought Corp. plant and delivered under urgent orders from the Navy Department, were received in Nicaragua during December and immediately placed in action.

These new planes, have been used unceasingly for bombing and "strafing" the rebel positions, causing heavy damage and keeping the rebels well under cover. They have also been used in daily flights for observation purposes, thereby keeping close account of all rebel movements.

Lieut. C. F. Schilt Transports 18 Marines

One of the greatest feats known in military aviation was recently accomplished by Lieut. C. F. Schilt of the Marines with the assistance of a "Corsair" plane. During one of the recent battles with the Sandino forces at Quilali, 18 Marines were injured, nine of them seriously, including Capt. Richard Livingston and Lieut. Merton A. Richal. As proper medical facilities were not available to care for the wounded at Quilali, Captain Livingston, in charge of the unit, was able to get a message through to Headquarters that immediate evacuation of the wounded was necessary to save their lives. The country surrounding Quilali is extremely wild and passable only by foot and with pack mules.

The message was transmitted to the Aviation Unit and planes were dispatched immediately with picks and shovels which were dropped at Quilali to be used in the preparation of some kind of landing field. The only fairly level spot for miles around was the road through the middle of the village which was only 15 ft. wide with a three foot ditch through it. The native shacks, all trees, etc., on one side of the road were demolished and a very rough runway only 300 ft. long was the best that could be obtained. There was a high bluff at one end and trees and a ditch at the other end of the emergency field with a 5,000 ft. mountain just across the river.

Vought Corsair with Pratt & Whitney Wasp engine such as the ones used by the Marines in Nicaragua.

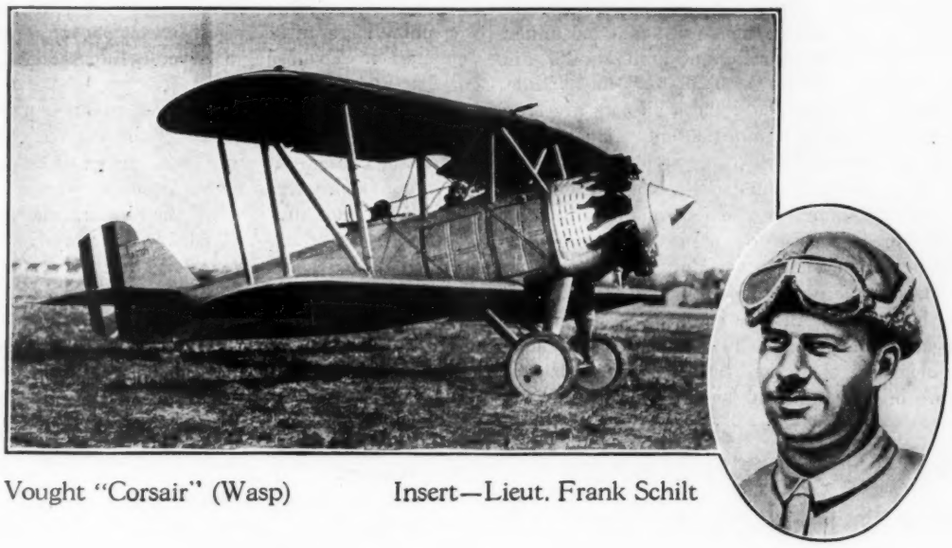
Assisted by Lieutenant Scribner

After obtaining Major Rowell's approval, Lieutenant Schilt started off with his Vought "Corsair" plane with its Pratt & Whitney Wasp engine. The first attempt was unsuccessful, but on the second try Schilt brought the plane into the field, stopping just short of the ditch at the end of the field. He was greeted as "An Angel from Heaven" by the band of Marines there. After the hard landing a careful examination was made of the plane and everything found intact, and the next job was to take off. Lieutenant Richal, who had a bad head wound, was taken aboard, the wing tips held until the engine was speeded up, the plane released and gaining speed down the short field took off successfully after two bounces, the "Wasp" engine pulling the plane out of the field almost like a helicopter. The next job was to dodge the bullets from the rebels who were firing at the plane from the mountains on all sides of Quilali, and this was done successfully with the help of Lieutenant Scribner who had been flying overhead in an escort plane firing on the rebel positions.

Captain Livingston, who also had been badly wounded, was taken on the next trip, and then 16 enlisted men in a total of 10 trips. Some of the less seriously injured were carried out two at a time. On the eighth landing the tail skid assembly was carried away and the plane took off without the skid, landing on the rudder, and on the ninth trip an interplane strut was bent, same being straightened out with an ax and wrapped with splints and wire.

All of the wounded men were taken to Ocotal, some 25 mi. from Quilali, where they were loaded into a large transport plane and taken to the hospital at Managua. The bravery and skill of Lieutenant Schilt, his confidence in his equipment, and the high-performance of his "Corsair" plane in the emergency cannot be praised too highly.

The MARINES and the "CORSAIR" in NICARAGUA



Vought "Corsair" (Wasp) Insert—Lieut. Frank Schilt

"The engine ('Wasp') pulled the plane out of the field almost like a helicopter"

Lieut. Frank Schilt

Lieut. Frank Schilt, U. S. M. C. reports that, in a Vought "Corsair," he rescued a number of wounded Marines in the mountains of Nicaragua after landing and taking off for a total of ten trips on a rough, quickly prepared run-way 70 ft. wide by 300 ft. long. This improvised field was entirely surrounded by dense forests and high, rugged mountains.

Low landing speed, coupled with quick take-off, is best exemplified in ships equipped with the air cooled radial engine, and is due primarily to low installed weight per horsepower. In hard service flying these characteristics are vital to the practical use of aircraft during actual engagement where perfect landing fields are never available. These same engine characteristics provide for the unmatched performance of the "Wasp" at altitude, and constitute the reasons for the "Wasp's" excellence in comparison to relatively heavier types of power plants.

PRATT & WHITNEY U.S.A. DEPENDABLE ENGINES

THE
PRATT & WHITNEY AIRCRAFT CO.
HARTFORD CONNECTICUT

DEPENDABLE ENGINES

N.A.C.A. Publishes Translations On German Glider Construction

THE NATIONAL Advisory Committee for Aeronautics has published two very interesting memorandums on gliders by Alfred Gynich, Technical Memorandums numbers 433 and 434 entitled "Some German Gliders of 1920-1923" and "Glider Construction and Design" respectively. These papers are from "Der Gleit und Segelflugzenbau" published by Richard Carl Schmidt & Co., Berlin, Germany, 1925. Dwight M. Miner of the National Advisory Committee made the translation.

The National Advisory Committee for Aeronautics is to be commended for this step in helping to further interest in gliding and soaring flight in this country. This art which is so far advanced in Germany is almost entirely neglected in this country. Besides being very instructive gliding is claimed by those experienced in the field to be a sport that is hard to rival. It is understood that these articles are to be followed by some more on the same subject.

Waco Plane Distributors Discuss 1928 Plans in Meeting at Troy, O.

DISTRIBUTORS OF the Waco planes recently met with company officials at the Advance Aircraft Co., Troy, Ohio, to disouss the accomplishments of 1927 and to outline sales plans for 1928. The meeting was called to order by Sales Manager C. F. Van Sicklen who spoke to the distributors on sales methods and plans. A general discussion followed.

This meeting of the distributors, the first of its kind ever called by the company, proved extremely successful and is to be repeated annually. With the entire output of the company covering the 1928 production sold out to the distributor organization, the sales system is functioning well and a good year is expected.

The Advance Aircraft Co. reports that figures on Jan. 1, 1928 showed an increase of more than 300 per cent. in daily production over Jan. 1, 1927. Five planes daily are to be built during the first 60 days of 1928, with an increase of the daily outpnt as fast as possible thereafter. New plants and field facilities are under way to meet this production plan.

Large quantities of the nine cylinder Ryan-Siemens radial engine will be used, it is said. Other engines of similar type are also being considered. These will be used, according to officials, as soon as their performance prove their worth.

Fischer and Jacobs Developing Seven-Cylinder Radial Engine

FISCHER AND Jacobs, automotive engineers of Philadelphia, have turned their attention to aeronautics and are engaged in developing a seven-cylinder radial, air-cooled aircraft engine.

First flying tests are expected about April 1, with engine mounted in either a Waco 10 or a Pitcairn PA-4. If the Waco is chosen, the tests will be made at the Philadelphia Airport, Island Road below Tinicum Avenue, where the Ludington Philadelphia Flying Service has the agency for Waco planes. If the PA-4 is used, the tests will be made at Pitcairn Field, Willow Grove, Pa., near Philadelphia.

The new power plant weighs 325 lb. as a maximum and is being designed to produce 120 hp. at 1,800 r.p.m. Work has been going forward for the past eighteen months under the direction of A. R. Jacobs, secretary-treasurer of Fischer and Jacobs and the company's chief engineer. Henry McFadgen, another engineer, is associated with Mr. Jacobs in developing the new engine. H. D. Carpenter is president of the company.

When the engine is completed a duplicate will be turned over to the Naval Aircraft Factory at the Philadelphia Navy Yard for exhaustive Navy tests, Mr. Jacobs said. Fischer and Jacobs, he states, are developing the engine to fill the demand that will arise for an engine similar to the fast disappearing OX-5. No details of the new engine will be announced until after it has successfully passed its flying tests.

Wichita's Seventh Plane Company To Begin Production of Biplanes

PRODUCTION OF a biplane of conventional design is soon to begin in the factory leased by the Lark Aircraft Corp. at Wichita, Kansas, according to reports. This corporation —the seventh airplane manufacturing concern in Wichita— is headed by Walter G. Barr, O. C. Baldwin is vice-president and associate engineer, and Fred G. McConiga, president of the Wichita Aero Engineering Service, is the chief engineer. The latter was formerly connected with the air mail service and during the World War was a government airplane inspector.

Glenn E. Gaston, a University of Wichita student, is secretary and treasurer. Romer G. Weyant, pilot, Roy E. Streeter and John P. Gleason are others in the corporation.

Waco distributors and officials of the Advance Aircraft Co. who recently met in Troy, O. Back row left to right, A. N. Conard, Dale Medley, L. N. Brutus, Clyde Shockley, Frank Clewers, R. S. Saltus, Stewart Chaddwick, M. E. Oliphant, T. Claude Ryan, C. W. Meyers. Center row, Franz Schwanke, Art Sheldon, E. E. Green, V. C. Omlie, Dick Young, Edward G. Knapp, Kitty Barrows, John P. Wood. Front row, seated, C. F. Van Sicklen, E. M. Ronne, P. H. Spencer, Eugene Stevens, C. J. Brukner, L. M. Brown, Charles Prohinsie, H. C. Young, Tex LaGrone, and John Livingston.

Airport Floodlighting

"Daylight at Night" Illumination produced by B. B.T. Air Mail Type Landing Floodlight

Intensity

An intensity of illumination that approaches the conditions for landing in daylight is essential for safe night landings. Maximum intensity insures the maximum safety.

The B.B.T. Air Mail Type Landing Floodlight illuminates the entire airport.

Landings may be made on any part of the field and in any direction. Surrounding trees, buildings and and other low obstacles, are made clearly visible to the pilot. This all insures safety.

Eventually every airport will require this most economical and efficient floodlighting.

The intensity is the maximum produced for airport illumination. It covers the largest area. Absolute freedom from glare is provided by a newly added feature. Adequacy for the future is assured.

Every airport lighting requirement is provided by B.B.T.—Beacons, Boundary, Obstacle and Ceiling Lights, Landing Floodlights and Exterior and Interior Hangar Floodlights.

CONSULT THE PIONEERS IN AVIATION LIGHTING
CATALOG GLADLY FORWARDED UPON REQUEST

B.B.T. CORPORATION OF AMERICA

ATLANTIC BUILDING PHILADELPHIA PENNA.

Beckwith Havens Becomes Sales Manager of Loening Corporation

BECKWITH HAVENS, pioneer aviator, recently became sales manager of the Loening Aeronautical Engineering Corp., giving up his active direction of Airships, Inc., of which he was vice-president. Entry of the Loening Aeronautical Engineering Corp. into the commercial field with a series of passenger amphibians developed from successful military types comes at the time Mr. Havens assumes the duties of his new position.

Beckwith Havens, sales manager of the Loening Aeronautical Engineering Corp.

Mr. Havens might be called the dean of civilian aviators for he has been flying since 1910 and still pilots his own plane. For three years he was a member of the group of exhibition pilots which Glenn H. Curtiss organized at Hammondsport and sent out on demonstration flights throughout the country. In 1913 he was the winner in the flying boat race around the Great Lakes, and with the declaration of war, he became an officer in the Naval Aviation service.

"The steady growth of commercial aviation is now assured," says Mr. Havens, who has lately spent several weeks surveying the field for the commercial amphibian. "We know that there can be no lagging in growth," he states. "As for the Loening Amphibian, we have two distinct channels for output. One is among the aerial service operators whose traffic includes flying over both land and water, and the other is among the many civilians who will find a use for this type of plane."

There have been three phases in the development of the Loening Amphibians. First came the service amphibian which used the inverted water-cooled engine and reached a degree of standardization with the Liberty and Packard engines. Second came the air-cooled amphibian built around the Pratt & Whitney Wasp engine. The new Loening Amphibians with air-cooled engines now offered in the commercial field represent the third stage.

Price of Alexander Eaglerock Increased to $2750 on Feb. 1

PRICE OF the OX-5 engined Eaglerock will be raised to $2750 on the Denver Field on and after Feb. 1, according to a recent announcement of the Alexander Aircraft Co. Additional features in standard equipment now embodied in the plane such as dual control, streamlined head rest, side door, and Berling magneto have necessitated the raise from the former price of $2475. The company announces, however, that the Eaglerock plus the new standard equipment but less the engine will sell at $650 discount.

Young Expects Plane Production To be Double or Triple in 1928

EXPECTATIONS THAT the airplane production of this country during the present year will be double, and probably triple, that of last year, has been expressed by Clarence M. Young, Director of Aeronautics, Department of Commerce. The total production for 1926 has already been exceeded in the first month of 1928. The airplane manufacturing industry proper reported 1,186 planes produced in 1926, while one-third of the industry has reported 1,525 planes produced thus far this year with 1,239 unfilled orders.

The Correct Weight of the New Miller 130 Hp. Engine is 300 Lb.

DUE TO an error in the Jan. 16, 1928, issue of AVIATION the wrong weight was given for the new air cooled 130 hp. engine being developed by Harry A. Miller, Inc., of Los Angeles, Calif. The engine weighs 300 lb.

S. C. Breder is Appointed General Sales Manager of Mahoney Corp.

"SAM" C. BREDER, for eleven years in the tire and rubber industry on the West coast, former Air Service man and in close touch with aviation since the World War has been appointed general sales manager of the B. F. Mahoney Aircraft Corp., builder of the "Spirit of St. Louis" according to word received from San Diego, Calif.

S. C. Breder, new sales manager of the B. F. Mahoney Aircraft Corp.

Mr. Breder replaces A. J. Edwards who has accepted a similar position with another company. Previous to this Mr. Breder had been acting in an advisory capacity with the Mahoney organization and thus was in good position to take over his new duties.

Consolidated Instruments have been standard equipment on Waco planes since 1925

How Many Planes in 1928?

Consolidated Instrument Sales forecast a great year for aviation

CONSOLIDATED Instruments have been selected as 1928 standard equipment for the planes of 32 of the approximately 40 manufacturers of commercial airplanes who actually are in quantity production. Our business, therefore, is an accurate barometer of aircraft manufacture.

It has been estimated that about 1700 commercial planes were produced in 1927. Our present rate of *actual deliveries* of instrument sets is on the basis of equipment for *3000 planes*. Furthermore, a number of our customers are calling for deliveries 30% in excess of their original orders.

These figures forecast a record-breaking year for aircraft production. And they indicate, too, that the majority of commercial planes will course the highways of the air with the dependable guidance of Consolidated Instruments.

CONSOLIDATED
Instrument Company of America, Inc.

41 East 42nd St., New York

Western Representative — M. E. Hulse, 1835 Park Boulevard, Oakland, Cal.

The type F Star Pathfinder compass is of the magnetic type and represents the latest development in aircraft compasses. It has a built-in compensating unit eliminating the use of troublesome loose magnets. This

unit is readily accessible for adjustment by means of a removable cover plate. This compass *mounts flush* with the instrument board surface. It has a spherical magnifying cover lens affording great visibility.

Altimeters, Tachometers, Oil Pressure Gauges, Gasoline Gauges, Thermometers, Air Speed Indicators, Compasses, Navigation Lights, Landing Lights, Dash Lights, etc.

The AIRSEDAN

Safety

Built under Department of Commerce Certificate of Airworthiness **No. 12.** *Approved for* **1000 lbs.** *pay load.*

INSURANCE

Full coverage will be granted for all passengers, because they cannot interfere with the controls.

SPECIFICATIONS

Seating Capacity	pilot and 4 pass.
Weight Empty	2100 lbs.
Wing Area	320 sq. ft.
" Span	42 ft.
High Speed (sea level)	120 M.P.H.
Engine,	Wright Whirlwind

EQUIPMENT

Self Starter, Metal Propeller, Compass, Air Speed Indicator, Navigation Lights, Tachometer, Altimeter, Clock, Fire Extinguisher; Fuel, Oil Pressure and Oil Temperature Gages; Air Corps Throttles, Strainer, and Fuel Valve, Exhaust Manifold with Muffler and Cabin Heater, Metal Mail or Baggage Compartment.

The Ideal Commercial Plane

Price $12,500 Flyaway
Completely equipped

BUHL AIRCRAFT CO.
Marysville, Michigan

Pacific Air Transport Control Acquired by Boeing Airplane Co.

PURCHASE OF controlling interest in the Pacific Air Transport Company, holder of the Pacific Coast air mail contract, by the Boeing interests of Seattle has just been announced. The PAT company will continue to operate under its old name and its policies will not be changed. However, an almost immediate development of coastwise air mail and passenger business is planned.

At the meeting of Portland, Seattle and San Francisco officials of the two companies held in Portland on January 16, P. G. Johnson, president of the Boeing Air Transport Co., and general manager of the Boeing Airplane Co., was named president of the PAT concern. Vern C. Gorst of Portland, former president and founder of the company, became one of the new vice-presidents.

Other officers of the reorganized company are A. K. Humphries, San Francisco, former PAT officer, vice-president; C. L. Egtbedt, designing engineer, Boeing Airplane Co., treasurer; R. C. Bradshaw, Portland, secretary; W. C. Mohler, San Francisco, of the old PAT company, assistant treasurer, and C. E. Brink, Boeing general auditor, auditor.

The new board of directors is made up of W. E. Boeing, chairman of the board of directors of the Boeing companies; Gorst, Johnson, Egtbedt, Bradshaw and Julius L. Meier and J. C. Ainsworth, both of Portland.

Corporation headquarters will remain in Portland and operating headquarters in San Francisco.

Contracts for four new passenger planes have been let to the Boeing Airplane Co. These will cost $25,000 each and will be added to the PAT fleet of twelve now in service between Seattle and Los Angeles. The new planes will accommodate four passengers besides the pilot and load of mail. They will be powered with Pratt & Whitney Wasp single engines. The planes are similar to those now being operated by the Boeing Air Transport on the Chicago-Salt Lake City lap of the transcontinental air mail line.

Three Engined Fokker Remains in Air Within Three Hours of Record

AFTER A fifth attempt to break the world's endurance record in a Fokker three engined monoplane Capt. Charles Kingsford-Smith and Lieut. George R. Pond were forced down due to insufficient fuel after a sustained flight of 50 hr. 4 min. They were 2 hr. 18 min. below the record now held by the German aviators Edzard and Risticz. In order to break the record one must surpass the present mark by at least one hour. In last week's issue of AVIATION the plane was described in detail mentioning the first four attempts that had been made for the record. On Dec. 20 they landed after a flight of 48 hr. 27 min. which was then believed to be a record for three engined planes. Additional fuel tanks were installed and on Jan. 18 they completed their fifth attempt to break the world's endurance record. It is believed that this mark of 50 hr. 4 min. has never been approached by any three engined plane.

According to reports when they took off from Mills Field, San Francisco, Calif., the plane weighed 15,710 lb. and as it had a wing area of 742 sq. ft. and was powered with three Wright Whirlwind engines, the wing loading was 21.2 lb. per sq. ft. and the power loading of 23.3 lb. per hp. (rating the Wright J5 engine at 225 hp.). The plane took off with 1,536 gal. of gasoline and therefore had an average consumption of 30.35 gal. per hr. for all three engines. In the first 24 hr. 1,050 gal. of gasoline were consumed while in the remaining time on-

ly 446 gal. were used. This meant a total fuel consumption of 43.8 gal. per hr. for the first day and only 17.9 gal. per hr. for the remaining time when the load was reduced.

This mark of over 50 hr. with a three engined plane is an excellent achievement and speaks very well for the men who prepared the plane for this test. It was a real test for the equipment which showed up in an excellent manner. It must be remembered that there were three times the engine installations on a plane of this type when compared with any of the other contestants for the endurance record. The plane the "Spirit of California" was subjected to a very heavy loading and it stood up exceptionally well. Philip C. Salzman was flight engineer for the project.

Arkansas Aircraft Co. Testing Plane Designed by Voellmecke

TESTS OF a new three place biplane are now being made by the Arkansas Aircraft Co. of Little Rock, Ark., according to a recent announcement by that company. The plane was designed by Albert Voellmecke, lately a member of the staff of the Ernst Heinkel Airplane Works in Germany, who has taken the position of technical engineer and designer with the Arkansas organization.

Although purchasers will be able to obtain the new biplane with the Curtiss OX-5 engine, the plane is primarily designed for modern production power plants of greater horsepower. Quantity production is to begin at an early date, according to officials, who report that the Little Rock factory is being equipped with new machinery following favorable showings of the biplane in the first tests.

Positiveness and lightness of controls, streamlines offering minimum resistance, and many safety factors are reported to be embodied in the design of the airplane. The trade name "Command-Aire" will be used.

A. J. Edwards to Tour Country As Sales Manager for Prudden

A. J. EDWARDS, who recently became sales manager of the Prudden-San Diego Airplane Co., manufacturers of the first tri-engined all-metal monoplanes to be constructed in the West, leaves San Diego on Feb. 1 to make a tour of the United States in a Prudden all-metal plane for the purpose of laying a sales foundation for this product. The plane is an eight place, dual control, tri-engined machine.

A. J. Edwards, sales manager of the Prudden-San Diego Airplane Co.

This tour is a step in the company's plans to manufacture all-metal airplanes on a large scale. The first plane made has been thoroughly tested, and admiration has been aroused, it is said, among many service and civilian fliers in San Diego. A single-engined six place plane is also being considered by the Prudden company, according to reports.

Mr. Edwards came to San Diego from Muskogee, Okla., where he was organizer and president of the Muskogee Avia-

Mark Your Airport with a Sperry Beacon

SPERRY AIRPORT AND AIRWAY BEACON

EQUIPPED with an automatic lamp changer.

Standard with the U. S. Department of Commerce.

Drum, base and trunnion arms made of corrosion resisting aluminum alloy. Weight of complete beacon is only 150 lbs.

Prices and further details upon request.

THE SPERRY GYROSCOPE COMPANY
BROOKLYN, N. Y.

tion Club. He first was manager of the B. F. Mahoney Aircraft Co., and incidentally was the man who sold Colonel Lindbergh his internationally famous Spirit of St. Louis.

A thorough familiarity with aeronautical sales work has been gained by Mr. Edwards. He has sold American planes in the United States, Japan, Honolulu, Australia, and Alaska.

"I believe that the all-metal manufacture of airplanes is as sure to come as did the all-steel fuselage which has now replaced the wooden," said Edwards in a recent interview.

Plan Large Increase in Capital Of International Aircraft Corp.

CAPITALIZATION OF the International Aircraft Corp. is to be increased from $100,000 to between $500,000 and $1,000,000 and incorporation is to take place under Ohio laws, according to a recent announcement of the removal of the organization from Long Beach, Calif., to Cincinnati, O., where industrial leaders have taken over the company. Control of the corporation was purchased through the activity of Perry V. Ogden, who becomes vice-president and general manager. Arthur E. Ewald, Cincinnati capitalist, is president.

Production in the large new factories at Cincinnati is scheduled to begin Feb. 1 with Edwin M. Fisk, designer and pioneer airplane engineer, continuing as chief engineer of the new corporation. All the machinery and most of the personnel of the Long Beach factory have been transferred east.

The new plant location lies near the Lunken Airport and the Watson Airport. Three former government buildings of the Ancor Nitrate Plant used during the World War, together with a concrete runway nearly a mile in length and a test field comprising 165 acres, make an ideal site for the factory. It is said that abundance of space will make this one of the largest commercial aircraft factories in the country.

One of the first sales territories allotted went to the Cincinnati Aircraft Sales, Inc., a new organization formed for the purpose of establishing dealers in the Ohio Valley. Lieut. Albert Wunder is vice-president and sales manager of the latter organization.

500 Super-Rhone Engines Ordered By Airplane Interests at Wichita

AN ORDER for 500 Super-Rhone radial airplane engines has been placed with Tips and Smith, Inc., manufacturers, by a group of Wichita, Kan., capitalists, according to a statement by J. C. Tips, Jr. Selection of this power plant to be used in several of the planes built at Wichita and elsewhere in the vicinity was made following numerous tests of the engine by W. B. Harrison, who recently reorganized the Swallow Airplane Mfg. Co. at Wichita.

The first shipment of the engines, 100 of which are to be delivered before June 1, is now being made, Tips announces.

Change in Price of Challenger Announced by Kreider-Reisner

THE KREIDER-REISNER Aircraft Co., Inc., of Hagerstown, Md., manufacturers of the Challenger airplanes announce that the price of their plane less air speed indicator, compass and dual control is $2785. These planes are being sold with complete equipment at $2945 at the company's field, Hagerstown, Md.

As the result of a printing error, AVIATION stated the wrong price for the Challenger in a recent advertisement of this company.

You Don't Need Two Hands to Use

THE FLASH

The New ONE HAND Automatic

FIRE EXTINGUISHER

Developed by the Air Corps at McCook Field

PRICES

Complete With Holder

Quart Size, each	$9.00
per doz.	81.00
Pint Size, each	6.00
per doz.	54.00
Cartridges, each	.20

Refill Liquid

One Quart	$1.25
One Pint	.75

Each extinguisher bears a warranty tag and guarantee

TO OPERATE

Strike button on end against some object. Press button on side to discharge.

JOHNSON AIRPLANE & SUPPLY CO.

Sole Aircraft Distributors

DAYTON OHIO

Write for Dealers and Manufacturers Proposition

Side Slips

By ROBERT R. OSBORN

We should like to have been able to present for this week's column a complete copy of the conversation between Roger Williams and Clarence Chamberlin on their recent attempt to break the world's endurance record, as they are, in our opinion, the cleverest and wittiest pair of fliers that ever got together. Chamberlin's record is, of course, very well known to everyone, but there are some statistics concerning Williams' aeronautical career which should interest everyone, and we take the liberty of devoting some space to these statistics. He is connected with the Curtiss Flying Service and since the first of May he has put in over 1100 hours in the air, most of it being in instructing students on Jennies. During the good weather he averaged about 18 students per day and 45 hours a week. One day he had 12 hours; one week he had 65 hours; and in one 10 day period had 80 hours of actual time in the air. So, about the only difference between his regular work and an endurance flight was that he didn't bother to come down to sleep and eat. As he explained it, his instruction was good training for the endurance attempt, as he slept most of the time while instructing, relying on the rough landings his students would make to wake him up in time to give them the usual bawling out.

On a Thursday, Friday and Saturday he and Chamberlin stayed aloft for nearly 52 hours. Repairs to the plane were made on Sunday and on Monday morning they were up again in another flight. If they had managed to stay up for the expected 60 hours on this attempt they would have had the unique record of 112 hours flying in one week.

• • • •

When they found, on their second flight, that they were on their last wing-tank full of gas, they threw out "everything not welded in place" so as to stall along as slowly as possible. The barrage included a five gallon can of oil, a gallon of water, thermos bottles, and flashlights. Williams said he would have thrown out Chamberlin's shoes too, but thought better of it, as "it would have meant sure death to anyone hit by one of them."

• • • •

Chamberlin said that Williams' jokes were terrible along toward the end and he finally had to pretend deafness,—"Sorry, I can't hear what you're saying." Williams claimed that his partner became almost stone deaf whenever there was any work to be done, too.

• • • •

Along about the middle of the flight the landing gear fairing on one side, the famous "tin pants", rattled loose and fell off. Lewis Solomon, who, with George Weis, hopes to make an endurance record, in a Stinson monoplane, says that this should be a warning to everyone not to buy a Bellanca unless an extra pair of pants is thrown in with the plane.

Williams said that he began to feel more at home in the plane after the vibration had put the rate-of-climb, altimeter and bank-and-turn instruments out of commission, as he had never been in an airplane before that had all of its instruments reading correctly.

• • • •

Both fliers explained to the reporters that their flight had been just a preliminary test,—that there had been some doubts whether they would be able to get along together for any extended lengths of time, and now that these doubts had been settled, their next flight would be a real one.

Here's wishing them luck!

Plane talk

If your ship is a Travel Air—

You give her the gun, take off quickly and smoothly, fly with the sureness of a hawk, with never a thought of discomfort or uncertainty, and float in for an easy landing.

And after each hop, your love for your ship stronger.

Get particulars by writing us.

TRAVEL AIR MFG. CO., Inc.
FACTORY AND GENERAL OFFICE—WICHITA, KANSAS
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RADIO EQUIPMENT FOR AIRPLANES and AIRPORTS

Now airplane companies and airports can equip with radio apparatus backed by the name and reputation of the Radio Corporation of America. Full information on radio telephone, radio telegraph and beacon radio equipment for communication between plane and plane, plane and airport, and airport and airport may be obtained from

Radio Corporation of America
233 Broadway New York City

Foreign Aeronautical News Notes

By Special Arrangement with the Transportation Division, Bureau of Foreign and Domestic Commerce

France-Argentine Service Postponed

Air service by the French Compagnie Aeropostale between France and Buenos Aires has been postponed to open at the end of January rather than earlier, H. H. Kelly, automotive trade commissioner at Paris, has informed the Department of Commerce.

On a trial trip, planes leaving Buenos Aires carried mail from Montivideo and Brazilian cities to Bahia for transfer to vessels touching at that point for the United States and Europe. Nearly five days time was saved on both routes. With the service established, it is expected that mail from Western Europe will reach Rio de Janeiro in six and one-half days and Montevideo and Buenos Aires within seven and one-half days after leaving Marseilles. The average between the points at present is 13 and 18 days respectively.

This service when opened will be an extension of the company's present service from Marseilles to St. Louis, Senegal, via Alicante, Spain, Tangier, Casablanca and Agadir, Morocco, and Port Etienne, French West Africa. This line has been in operation for several years. Connections will be made with the Cape Verde Islands from which fast steamers will carry mail to the Island of Fernando do Noronha off the coast of Brazil. From here to Natal, also off Brazil, seaplanes will again be used. One round trip per week is planned.

Swiss City Served By Seven Air Lines

Switzerland's aviation season will begin this year on April 23, according to a report from Consul Calvin M. Hitch at Basel. This city, served by seven air lines, will have direct connection by air with many of Europe's principal cities. The schedule follows:

1. Geneva, Zurich, Basel, with connections at Zurich for Munich, Vienna, Budapest, Prague and Breslau.
2. Basel, Freiburg, Stuttgart, Berlin.
3. Geneva, Basel, Manheim, Frankfort, Hanover, Hamburg, Copenhagen, Malmo, with night train connections in Malmo for Stockholm and Oslo.
4. Zurich, Basel, Brussels, Rotterdam, Amsterdam, with connections in Brussels for Antwerp and London.
5. Zurich, Basel, Paris, London.
6. Basel, La Chaux de Fonds, Lausanna.
7. Basel, Zurich, St. Gall, Munich.

At all of the important cities mentioned, air service connections will be maintained with other European cities.

Rome-Milano-Trento

A new air service, connecting Rome, Milano and Trento, will soon be opened in Italy. In connection with the opening of this route, a new type of terminal will be constructed.

The Modern Pony Express

STEARMAN Mail planes are flying on the Varney Air Lines and the Colorado division of the Western Air Express. Each airplane is completing six thousand miles of strenuous flying every month.

The Stearman Whirlwind Mail Plane

STEARMAN AIRCRAFT HAVE A PERSONALITY

The Stearman Aircraft Co., Wichita, Kansas

Italy Third in Traffic

Italy has reached third position in international aerial traffic being surpassed only by Germany and France, according to a report received by the Department of Commerce from Asst. Trade Commissioner D. F. Spencer, Rome. Italy's progress is regarded as somewhat remarkable when it is considered that the principal lines are both overseas and overland and are operated almost exclusively with hydroplanes.

Furthermore, it is said, few nations have had the land handicaps and obstacles to overcome such as crossing the Alps or Appennines even on short runs.

During 1928 the air lines to be completed are the following: Rome-Milan-Trento-Monaco; Rome-Sardinia; Brindisi-Valona and the Rome-Brindisi, all of which will connect the principal regions and cities with a thoroughly organized system of transportation. Italy is also said to be looking forward to incorporating the Genoa-Barcelona line into a trans-Atlantic line extending from Italy to America

New Amphibian for Luft Hansa

Construction work on an amphibian plane for the German Luft Hansa was started recently by the Dornier Aeroplane Works at Manzell, Germany, where 200 men are engaged in the building of aircraft. The power of the new plane is to be furnished by two 650 hp. Rolls-Royce engines driving two four-bladed propellers. The plane will be 87.4 ft. long, 17.7 ft. in height, and approximately 18,430 lb. in weight, while the wing spread of the plane is to be 94 ft., and a speed of 111.8 m.p.h. is expected.

Two small planes of the Dolphin type are also being built at the Dornier plant for the Luft Hansa. These are to be used on German lakes for amusement and commercial purposes.

Grant Mexico City-Texas Concession

Two concessions for air service from Mexico City to Brownsville, Texas, on the American border, and from Mexico City to the Guatemala border have been granted by the Mexican government, according to a report to the Department of Commerce from American representatives. The former service, granted to the Compania Mexicana da Aviacion, will be via Tampico.

The Mexican Pan-American Airways of Mexico City holds the concession between Tampico and Brownsville. The two companies will cooperate in giving service from Mexico City to the border.

Shilling Air Taxi Rate

According to a report received at the Department of Commerce from the American Consul at Melbourne, Australia an air taxi service is planned in the Midhur-Broken Hill district of Victoria and New South Wales by a new aviation company formed recently in Melbourne. The company has announced that it will charge one shilling a mile for taxi service.

Chile Purchases Detroit Aircraft

The Chilean government has ordered $200,000 of Detroit-made airplanes, according to a statement by Richard Stevenson, assistant manager of the United States Bureau of Foreign and Domestic Commerce, at a dinner given by the Motor City Traffic Club recently.

Argentine-U. S. Air Mail

Negotiations for the transfer of Argentine mail for the United States to air mail planes immediately upon arrival in New York City are being carried on, the Director-General of the Argentine Postal Service announced recently.

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International
Airplanes

For the states of
OHIO, INDIANA, KENTUCKY & WEST VA.

Choice DEALER TERRITORIES now open

Write or wire

The CINCINNATI AIRCRAFT SALES Co.
601 Chamber Of Commerce Bldg.
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The INTERNATIONAL *is manufactured in Cincinnati*

Austin Designs and Builds Aviation Buildings

AUSTIN designs, constructs and equips efficient hangars, factory buildings and other structures at *low* cost.

Austin guarantees total cost, completion date and quality of materials and workmanship.

Austin will also deliver steel and other essential materials for erection by a local builder at a decided saving in time, worry and expense.

Representative companies from coast to coast have used Austin building service.

Ask for approximate costs and folder, "Austin Builds for Aviation".

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Architects, Engineers and Builders for the Aviation Industry
CLEVELAND, OHIO
New York Cincinnati Pittsburgh St. Louis Chicago Philadelphia Seattle Portland Detroit The Austin Company of Texas: Dallas The Austin Company of California: Los Angeles and San Francisco

AIRPORTS AND AIRWAYS

Syracuse, N. Y.

By John S. Pendergast

The work of the weather forecaster was explained at the last meeting of the Syracuse chapter, National Aeronautic Association, by Morgan R. Sanford, in charge of the United States Weather Bureau at Syracuse University. Mr. Sanford discussed the weather man and his relation to aviation.

The forecaster explained that eight-tenths of all the storms that cross the United States slide out into the Atlantic over the heads of New York and New England's umbrella toters, whether the storm originates in Vancouver, San Diego, Tia Juana, Dallas, Key West, or Nova Scotia.

He said that there are atmospheric conditions which may affect rain moving east. An upsurge of warm air, for instance, might eliminate a rain storm in its vicinity.

Mr. Sanford explained for the fliers the formation of cyclones and tornadoes, calling the latter cyclones standing on their beam ends. The cyclone, he said, is a circular storm formed something like a lady's muff with the muff moving east although the wind spin is to the left. The tornado is of the same formation, Mr. Sanford explained, except that it slides along on end and is therefore a taller storm than the cyclone. An airplane could fly over either of these types of storms under normal conditions, he continued.

Mr. Sanford was asked the possibility of such storms occurring in high air strata but assured the questioner that a tornado is strictly a ground floor proposition and there are no second story cyclones.

The forecaster further explained the formation of rain and hail and asserted that probably the greatest menace to aircraft of today is the sleet storm. As in cyclonic storms, however, the airplane can climb above the sleet, he said.

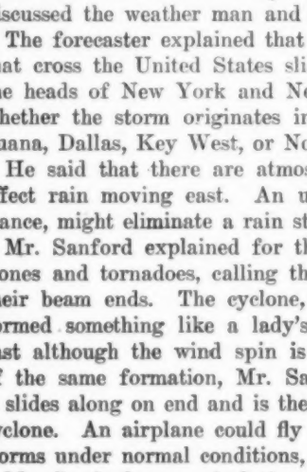
Mr. Sanford's was the first of a series of lectures arranged by the local chapter to constitute a ground school course for interested members.

Police Department to Have Plane

Syracuse will probably have the distinction, it is stated, of being the first American city to purchase an airplane for the use of its police department; for an item of $2,000 for the purchase of an airplane was included in the budget for 1928 submitted by Chief of Police Martin L. Cadin. The Board of Estimate and Apportionment gave its approval and the plane will be purchased in the spring.

Gordon K. Hood, manager of the municipal airport here, will be appointed pilot of the police plane. He will be Syracuse's, and possibly the country's first official "sky cop".

Purchase of a police plane is considered by Syracuse aviators as positive proof of the air-mindedness of their city. Perhaps many other cities will boast of a fleet of police planes



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within a few years but as far as is known Syracuse will be the first.

Chief Cadin, in recommending that the city purchase an airplane for the use of his department, called attention to the fact that speed is many times necessary in police work. The fastest speed as we know it today is the air, the chief added.

The plane is to be used in the pursuit of criminals and for transporting prisoners. It is planned that if a man wanted in Syracuse is arrested in another city the plane will take off here on the same day, fly to where the man is held, and return him via the air.

A cracked spark plug porcelain recently forced George Haldeman, pilot of Ruth Elder's plane on its unsuccessful attempt to bridge the Atlantic, to land at the municipal airport here. He arrived unheralded, taxied his Fairchild monoplane into the new municipal hangar, and registered at a local hotel without revealing his identity.

It was not until the following morning when Haldeman made inquiries about the management of the airport that his identity was revealed. He left shortly afterwards for Mineola, accompanied by Mr. and Mrs. Richard E. Welch. Mr. Welch, a newspaperman, was invited to take the trip by Haldeman. Haldeman's plane was the first to occupy the new municipal hangar which was rushed to completion here when Mayor Charles G. Hanna realized the great need for it. The hangar is of structural iron, sheet metal, and asbestos construction and is of the most modern type.

Haldeman's trip from Syracuse to New York City was made in 2 hr. 45 min. A fresh tail wind helped him considerably on the flight.

Gordon K. Hood, manager of the airport, announces that planes from nearby cities have been landing at the municipal field throughout the winter. Contrary to expectations, the port has been a busy place, therefore, despite the cold and snow.

Philadelphia, Pa.

By Ray Krimm

Three Waco 10's and a Waco 10 seaplane have arrived at the Philadelphia Airport at Island Road below Tinicum Avenue as the first shipment in the order for 64 Wacos recently placed by Charles Townsend Ludington, president of the Ludington Exhibition Co., airport lessee.

Robert P. Hewitt, manager of field operations at the airport, supervised the unloading of the four dismantled planes, which have been stored in a large barn near the field. The two Ludington hangars at the field are already filled with planes, eight planes owned and operated by Philadelphians being stored in one hangar and the company's seven standard and experimental planes being kept in the other.

The new Wacos are expected to arrive here at the rate of ten dismantled planes per month from the Advance Aircraft Co., Troy, O.

R. Sanford Saltus, Jr., vice-president of the Ludington Philadelphia Flying Service, and president of the Aero Club of Pennsylvania, has agreed to the consolidation of that club with the Philadelphia chapter of the National Aeronautic Association, headed by Hollinshead N. Taylor, chairman of the Aviation Committee of the Philadelphia Chamber of Commerce. The proposal will be placed before a joint meeting of the two organizations late in January.

Recent flights by officers of the Twenty-eighth Division Air Service, Pennsylvania National Guard, included a trip to Lakehurst by First Lieut. Robert P. Hewitt and a flight to Bristol by Maj. J. Sidney Owens, commanding the service. Both trips were made in one of the division's new Consolidated PT-1's, of which it has two on temporary issue.

The division is scheduled to receive three Curtiss O-11 Falcons, with Liberty engines, in February or March, Major

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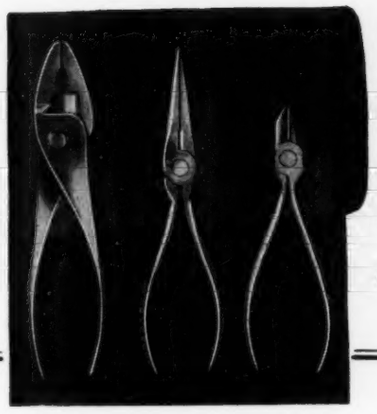

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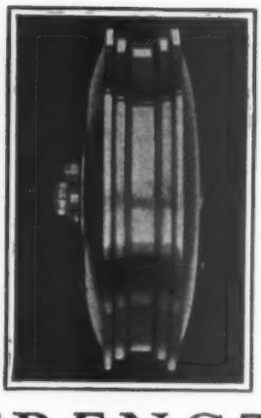

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Owens announced. It will also get five advanced training planes at a later date.

Seven leaders in aeronautical circles throughout the country have been invited to an aviation rally to be staged by the Poor Richard Club, Philadelphia advertising organization, in connection with its annual banquet this month. Prominent fliers who will attend include Lieut. Comdr. Charles Rosendahl, captain of the naval dirigible Los Angeles; Ralph D. Weyerbacher, chief of the Naval Aircraft Factory, Philadelphia Navy Yard; Floyd Bennett, who accompanied Comdr. Richard E. Byrd to the North Pole; Bert Acosta, who crossed the Atlantic with Byrd; Clarence E. Chamberlin, who piloted Charles A. Levine from New York to Germany; Lieut. Lester Maitland, non-stop flier between San Francisco and Hawaii, and Lieut. Bernt Balchen, North Pole flier.

The ballroom of the Bellevue-Stratford will be transformed into a miniature landing field. Leaders in the aviation industry will speak and there will be special aviation motion pictures.

Erie, Pa.

The Aero Club of Erie, headed by President Harold F. Mook, has completed an educational aviation campaign to acquaint Erie's business and industrial leaders and the general public with the advisability of establishing a municipal airport.

As a result, a definite action toward procuring a site for such a field is expected to be taken by city authorities before summer. Inspection trips to available sites have been started and general interest has been awakened.

J. G. Osborne, perhaps the best informed aviation enthusiast in Erie on airport requirements, has appeared before civic organizations, service clubs, and other organizations, explaining the city's need for aeronautical activity and the benefits that could be expected if a municipal airport were established.

The Aero Club of Erie, having completed one educational campaign, has started work on another, this time directing its attention to surrounding communities. In addition to Mr. Mook, the club's officers are A. W. Reichert, vice president; E. R. Hazen, secretary, and Howard Hudson, treasurer.

Johnstown, Pa.

Robert S. Waters heads the Airport Committee of the Johnstown Chamber of Commerce, which, for several months, has been inspecting sites for the establishment of a municipal airport.

Other members of the committee include George A. Foster, W. W. Moore, Russell H. Heffley, Louis Franke, W. W. Davis, C. L. Baker and W. W. Krebs. The committee cooperated with Walter O. Snyder, airways extension superintendent of the Bureau of Aeronautics, who recently made an inspection tour of available sites in and on the outskirts of Johnstown.

Mr. Snyder's report recommended as the most promising site a stretch of land adjoining a golf course. The matter is being given careful consideration by the city and definite action is expected within the next few months.

Scranton, Pa.

Aroused by the interest taken in aviation, the Scranton, Pa., chamber of commerce has appointed a committee to study the problem of securing an airport for Scranton. William F. Hallstead of the Scranton *Sun* is chairman of the committee. This paper has pushed the airport project continually for several months, and an airport is now assured.

Members of the chamber of commerce were recently addressed by a representative of the Ford Motor Co. speaking in the interests of aviation. A Ford-Stout tri-engined plane was to be exhibited at the meeting, but a change in plans prevented its arrival at the last minute.

Hazleton, Pa.

Hazleton is working toward the establishment of a Municipal airport. Lewis Maue, Eckley B. Markle and A. Oscar Reinhart have been appointed members of the Hazleton Chamber of Commerce Airport Committee, with Mr. Markle as chairman.

The committee has visited several prospective sites for the airport and is preparing a report on which the city will be asked to take action.

Spokane, Wash.

By E. Harve Partridge

Purchase of a flood lighting system for the Spokane Airport has been authorized by the city council. Lights were used during the national air races but had only been loaned to the city and to the National Guard. City commissioners heard arguments as to the necessity of having lights for the field and passed an emergency ordinance setting aside necessary funds.

Three new Wacos have been delivered to the Mamer Flying Service by the Rankin Flying Service of Portland, northwest distributors. Pilot Nick B. Mamer flew the planes to Spokane from Portland.

During 1927 the Mamer Service, working off the Spokane Airport, carried 800 passengers, made 60 cross country trips including 14 over the Cascade mountains, sold eight new planes and two used machines, and sold two engines. Planes of the service also took part in four aeronautical contests, including the Class A transcontinental air derby from New York to Spokane. Mamer in his Buhl Airster placed third in the race.

Fifteen students were graduated and 30 were enrolled at the end of the year. Arrangements have been made whereby the ground school instruction will be given by the Institute of Business and Science, with Pilot Mamer acting as instructor in night school classes. The school has a total of 437 students enrolled. Air instruction is to be given by Mr. Mamer and his co-pilot W. W. Williams. The entire work is being so arranged that students can learn to fly without interference to their regular employmnt time.

Winston-Salem, N. C.

By Robert Carmichael, Jr.

Winston-Salem's first school of instruction in aviation was recently opened at Charles Field on the southern limits of the city, by G. R. Pope, and Kit Carson, formerly of Los Angeles, Calif. Pope owns the Eaglerock plane being used, and Carson is the instructor.

Mr. Pope has just been appointed Eaglerock distributor for seven counties surrounding Winston-Salem, serving under J. Shelly Charles, Richmond, Va., distributor in North Carolina, Virginia and District of Columbia.

It is understood that several local people have already made inquiries as to the instruction course and Pope and Carson are anticipating a comparatively large class within the next few weeks.

Mrs. Hattie Meyers Junkin, part owner of Advance Aircraft Co., Troy, Ohio, is spending a week in Winston-Salem visiting friends. She formerly made her home here.

Mrs. Junkin is popularly known as "Mrs. Waco". She is a sister of Charlie Meyers, winner of the New York-Spokane air derby and now test pilot for the Waco company. She told friends here that her company is planning additions to its plant that will increase production to about 3,000 planes annually.

J. Shelly Charles, Richmond, Va., Eaglerock distributor, has returned to Richmond, after spending the holidays in Winston-Salem. He flew here in an Eaglerock which he delivered later to a purchaser at Raleigh. He stated that he had enjoyed

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excellent business during the past year and has orders on hand that indicate 1928 will be a record-breaker in airplane sales.

Charles had the misfortune to have his New York-Spokane air derby plane to burn up recently as it stood in its hangar at Richmond. The Eaglerock accidently caught fire while mechanics were working on it. It burned before help could be obtained.

Camden, N. J.

By Ray Krimm

In furtherance of their campaign to have New Jersey adopt state regulation for aircraft operating within its borders, officials of the South Jersey Aviation Club, headed by Maj. E. A. Cryne, Air Service Reserve, will hold a conference late this month with three members of the Pennsylvania Aeronautics Commission.

The conference will be for the purpose of learning what steps were taken by the Pennsylvania commissioners when they drafted the state aircraft regulations recently, Major Cryne announced.

Edgar N. Gott of Bristol, president of the Keystone Aircraft Corporation, Maj. Charles Biddle of Philadelphia, and Hollinshead N. Taylor, president of the Philadelphia chapter of the National Aeronautic Association, are the three Pennsylvania commissioners who will attend the conference. They served on a special committee that drafted Pennsylvania's regulations.

Civic and service organizations and clubs in and near Camden have joined in the campaign to have Col. Charles A. Lindbergh visit this section when he returns from Central America. An invitation will be extended the flier immediately upon his return.

Duluth, Minn.

By H. A. Lindbergh

Walter A, Brooks, airplane and engine inspector of the Aeronautics Branch of the Department of Commerce, was in the city recently to inspect the site that had been selected for an airport by the committee from the Junior Chamber of Commerce. After a thorough investigation of the property and the tentative plans he mentioned that the proposed location at Sixty-third Avenue West and the bay front is favorably situated for future requirements.

Some filling would be necessary from the slip line near the dock front of the Zenith Furnace Co. at Sixtieth Avenue West to Indian Point at about Sixty-fifth Avenue West. By so doing it would be possible to increase the present proposed acreage of 65 to about 100 acres, with the field being enclosed in an area about seven blocks long and five blocks wide. There are no obstructions for landing and take off in three directions, but in the fourth there are two smoke stacks of the Zenith Furnace Co. The intended site is near a large body of water available for the use of airplanes and amphibians and is not far from the business section of the town.

Los Angeles, Calif.

Don Williams, C. N. Shelton, and Frank Temple recently soloed at the Dycer Airport here. All performed creditably, keeping clean the airport's record for student solo flight, all of which have been without accident.

One student, Walt Higley, is approaching solo qualification, though he has had less than six hours of dual instruction. A student may be qualified in less than 10 hours, but instructors here do not believe this advisable. Higley was formerly an auto racer of some fame.

Other students enrolled since Oct. 1, 1927, are A. M. Bilyieu, Charles Black, E. F. Branesky, Clark Brundage, Gregory Chase, Walter Carston, Mark Darr, Frank Delano, E. E. Dohrer, Earl Ellis, A. V. Geldart, Ed. Higley, Don Hammel, Don Jeancon, E. J. Juno, H. B. Knapp, W. F. Palmer, Oliver Pavillo, E. Rosenoe, Oscar Schlotter, H. F. Toole and Keith Ward.

Baltimore, Md.

By Harry Rudo

Baltimore Airport stock to the amount of $1,500,000 has been put on sale. It bears interest at the rate of 4 per cent. and is in the form of coupon bonds.

A program of airports for the towns in Maryland—Frederick, Hagerstown, Crisfield, and others—is under consideration. John A. Hambleton, Baltimore banker and aviator, and other men, are strongly in favor of this plan. Good air fields on the eastern shore of the Chesapeake would save considerable time in transportation across the bay. About 250 acres it is thought, would be adequate. The cost for the land is estimated to be from $2,500 to $25,000, depending on the values in different parts of the state.

However, there is also objection to the plan, because it is claimed airports are unnecessary for the present in the smaller cities and the terrain is said to be favorable for landings.

By April 1, the Maryland National Guard Air Service will receive three O-11 and two PT-3 type airplanes, the latter with Wright Whirlwind engines. Thus there will be four types of airplanes and three types of engines in the Observation Squadron.

Captain Black Establishes Record

Capt. Edward C. Black, of the Army, recently established a record for two passenger planes in cross-country flying when he covered the distance of 436 mi. between Dayton, Ohio, and Baltimore in 2 hr. 45 min. or an average of 158.4 m.p.h.

The plane used was a Douglas O-2 which previously was in the air mail service and which has been remodeled to accommodate two passengers. He was aided by strong winds and good weather. Lieut. Charles H. O'Connor, of the Air Corps, was a passenger.

The giant Sikorsky biplane, Guardian, which was en route from Curtiss Field, Washington, landed at Aberdeen after one of its two engines went dead 30 min. before. The trouble developed while passing over the lower tip of Delaware. After an attempt was made to fix the engine 500 gal. of gasoline were jettisoned.

Lieut. Leigh Wade of around-the-world flight fame was at the controls. The plane also carried Igor Sikorsky, designer and builder of the Guardian, Maj. R. H. Fleet, president of the Consolidated Aircraft Corp., Henry G. White, pilot, William Whestly, engine expert, and three mechanics.

The plane was built as an entry in the competition for a standard bombing plane for the Air Service. It was on its maiden flight and was to be inspected at Washington by army and navy officials, then to proceed to Wright Field, Dayton, Ohio for bombing tests. Because of the cold weather, which made working on the motor difficult, the hop-off was delayed a few days.

Tulsa, Okla.

By Ernest W. Fair

Tulsa is fast becoming one of the most important air centers of Oklahoma with its greatly improved airport and splendid markers. The huge arrow circle with Tulsa written on it and pointing to the field has long been one of the most reliable of markers.

McIntyre Airport is doing much to further aviation in Oklahoma with its advertisements in leading state publications. The largest of these, "My Oklahoma", carries an ad each month showing a young man before an airport telling of Oklahoma's aviation opportunities. Many commendations are due McIntyre for this work.

Mrs. Evangeline Lindbergh passed through here on her trip south to Mexico to visit her son, Col. Charles A. Lindbergh.

Al Henley, co-pilot with Griffin in the attempted Dole flight of those two fliers, is manager of the Ryan Airlines agency here and has been selling many planes. He has flown his

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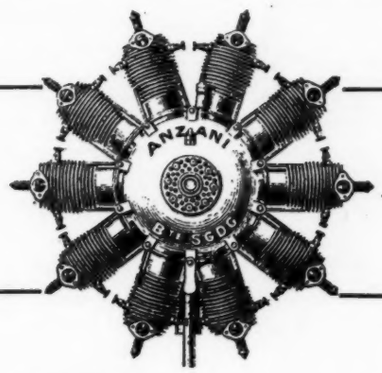

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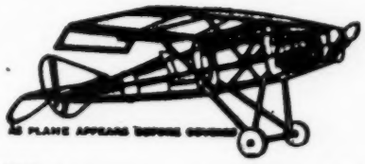

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A WELL KNOWN automobile distributor, with a large, fully equipped plant, located in the Hudson valley, near New York, is interested in the promotion of Aviation. A flying field is located near the town and is being considered as a municipal field. This company is interested in the exclusive agency for a good small plane in three surrounding counties and will operate a flying school in conjunction. There is a show room large enough for the display of a plane. The company is interested in getting the plane on display immediately. Manufacturers and pilots please communicate. Box 770, AVIATION.

plane to many important cities of late and has done much boosting for Tulsa.

Comdr. Richard E. Byrd spoke here on Jan. 13.

Norman, Okla.

Jimmy Hazlip and Cheebie Graham, owners of the Oklahoma Air Transport Co. here, have been doing a larger amount of business in the past few weeks than ever before. More student flights and more passenger flights have been made. The field has been leveled, tall grass cut, and the hangar has been put in top shape.

Frank Dennis, editor of the student newspaper at the university, is one of the students who has finished his flying instruction. Several new students have enrolled in the course during the last few weeks.

A Bright Spot in the Night

Oklahoma City's National Air Transport hangar lighted up at night.

Okmulgee, Okla.

The lease for the municipal airport here has been signed and work is to be started at once to put the field into shape to meet all modern requirements. Grading, and other necessary improvements, have already been begun. Okmulgee is in a position to take care of much air business, rumors having at times placed it on contemplated air routes to cross Oklahoma from east to west.

The city has a population of 20,000-25,000 people, 17,430 being the 1920 census figure. This new airport will do much to facilitate business here. The lease binds the Okmulgee Aviation Club, formed here recently, for five years. Fenton M. Wood is president, Roy Black, vice-president, and Harold S. Foster, secretary-treasurer. The new field is two miles east of the city and is immediately north of the Morris concrete highway.

New Rochelle, N. Y.

We would like to correct an erroneous impression which was created in the report on the flying field at Armonk, N. Y., in the Jan. 16 issue and which concerns the Atlantic Airways, Inc.

This organization has not moved from New Rochelle, but has only rented part of the hangar at Armonk for the storage of one of its planes over the winter months. It is expected that operations will start full blast at this field in the early spring. The Atlantic Airways, Inc., are the Eaglerock distributors for greater New York.

Caldwell, Idaho

By Robert Blackstone

The aviation committee of the Caldwell chamber of commerce has passed a resolution, requesting the Department of Commerce to change the name of the local airport from that of Frost to Walker Field. The field is located on the Walker estate. The request goes on to say that "this would be a memorial to the late Milton L. Walker, realtor and breeder of pure-bred stock."

The permanent airport committee named recently by the chamber consists of Amos Miller, R. C. Pasley and Fred McConnel. The committee has already announced that another runway will be built in the spring and a wind socket erected. The committee's immediate activities are centered on getting power and telephone extensions to their municipal airport. As soon as a light circuit is available a system of flood lights will be devised for night landing.

Emmett, Idaho

Workmen for the Department of Commerce are busy erecting a tower here for the powerful beacon which is part of the light system from Boise to Pasco—the north end of the Salt Lake-Pasco airway.

The emergency landing field here of 100 acres, located on the Olmstead estate southwest of town, will not have this beacon alone, but also will be equipped with flood lights and telephone. The government is paying an annual rental of $758 for this field.

La Crosse, Wis.

La Crosse is one of the three Wisconsin cities on the air mail and passenger route operated by the Northwest Airways between Chicago and the Twin Cities.

Although the city does not own or control an airport at the present time, it seems to be a possibility that a field will be acquired within a few months. A site is now being considered that has been in use for about seven years and is considered as one of the best in this section by pilots who have used the field.

This airport, which is used by the air mail planes, consists of a 120 acre tract of land about two miles southeast of the city on which there is a warming house and one hangar. The route from Chicago to La Crosse, which is traveled by the air mail planes, is lighted for night flying, but the remaining route to the Twin Cities is minus the beacons to guide the night fliers. Aid is promised for the pilots within the near future, however.

Escanaba, Mich.

Four owners of planes in Escanaba are planning on providing an adequately equipped airport for their city during this new year. They intend to erect hangars for the planes already in use here and several others which are to be purchased during the coming summer. In addition to this, the plans call for a repair and supply shop, gasoline station for the planes, and other facilities required at a good airport. In order to help to cut down student living expenses, dormitories will be built near the field.

Concord, N. H.

The ceiling of the shop in the hangar of the Concord Airport has been sheathed with celotex and an oil heater installed, so that now work can be done very comfortably in the shop no matter how cold it is outside.

Work on the field itself has stopped for the winter because of the deep frost in the ground but will be resumed as early in March as possible.

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UNITED STATES AIR FORCES

Falcons Delivered to Air Corps

Nine Curtiss O1-B Falcon observation planes, which type is now standard for the Air Corps, were assigned to Mitchel Field and delivery has already begun.

Approximately 100 of these planes are in course of construction at the Buffalo plant of the Curtiss Aeroplane and Motor Co. The majority will be equipped with Curtiss D-12 engines, and all of those coming to Mitchel Field will have this power plant. Those observation planes designed for use of the various National Guard units will be powered with the Liberty engine.

A total of 76 additional Curtiss Falcons, constructed as attack planes, will be sent to Fort Crockett, Texas, for use by the Third Attack Group. These planes will be powered with the D-12 engine. With their six machine guns, two of which are streamlined into the lower wings, two firing between the blades of the propeller and two operated by the gunner or observer, these planes have attracted widespread attention around New York. In a trifle over a minute, the 2600 bullets can be discharged, each gun firing 400 shots a minute.

Planes Used as Flying Offices

The Falcon plane seems adaptable to many military purposes. In addition to being the standard observation and attack plane, two assistant secretaries of war and two generals of the Air Corps use them as flying offices. The last deliveries were made on Dec. 18, when Maj. Gen. James E. Fechet accepted his plane at Mitchel Field and with Capt. Ira C. Eaker, flew it to Washington. Lieut. E. P. Gaines left for Wilbur Wright Field with the plane assigned to Brig. Gen. Wm. E. Gillmore. Earlier deliveries were made to Assistant Secretaries of War, Hon. Hanford MacNider and Hon. F. Trubee Davison.

These planes, which have been painted in distinctive colors, have a mahogany desk ingeniously built into the rear cockpit. They are to be used on inspection trips throughout the country. It is possible to write in the plane while in flight, and the glass top of the desk is so arranged that documents and maps can be slid underneath for extended study. Another feature is the complete instrument board in the rear cockpit which, with the dual controls make it possible for the assistant secretary of war or generals, all of whom are at present pilots, to fly independently of the occupant of the front cockpit.

The fact that the Falcon attack planes, in addition to their six machine guns, carry bomb racks on the lower wings with a quantity of 25 lb. bombs, makes it possible that they will yet appear as light bombardment planes. With the Curtiss D-12 engine and a full complement of bombs it would have a speed of 147 m.p.h.

Lieut. R. S. Barnaby Becomes Inspector

Lieut. Ralph S. Barnaby, U.S.N., has left the Bureau of Aeronautics, Navy Department, Washington, D. C., to take up his new duties as Assistant General Inspector of Naval Aircraft, Central District, Wright Field, Dayton, Ohio.

Barnaby has been in charge of the specifications section of the Bureau during the past five years. He has been identified with aviation for many years, however, having built and flown man-carrying gliders in 1909 and power driven airplanes in 1912. During the World War, Lieutenant Barnaby resigned as assistant chief engineer of the Standard Aeronautical Corp. to enlist in the Navy.

General Patrick Trophy Presented

A new trophy was added recently to those for which Army Air Corps officers may compete in aircraft races, when Assistant Secretary of War for aviation F. Trubee Davison presented the Major Gen. Mason M. Patrick Trophy, to be competed for by officers assigned to the Third Attack Group, Army Air Corps, Fort Crockett, Tex.

The trophy was given by Mr. Davison, in charge of Army aviation, as a tribute to the splendid services performed by Major General Patrick.

Presentation of the trophy was made at a dinner given Major Gen. and Mrs. Patrick by Army Air Corps officers at the Army War College. At the same time, General Patrick received a limousine from officers under his command as a token of their regard.

The General Patrick Trophy is a bronze plaque, 24 inches wide and 18 inches tall, mounted on an ebony frame. Its upper half shows a pylon in the foreground toward which five attack planes are racing with throttles wide open. The leading plane is rounding the pylon with the others in close pursuit. Beneath this scene are seventeen wings similar to those worn by flying officers. Beneath each wing is a space for the inscription of the names of the winners of the various races from year to year.

Other trophies for which Army Air Corps officers compete from time to time are:

John L. Mitchell Trophy—for pursuit planes (limited to First Pursuit Group, Selfridge Field, Mich.)
Packard Motor Car Company Trophy—for large capacity airplane bombers
Liberty Engine Builders Trophy—for observation planes.
Pulitzer Trophy—for high speed racing planes.
Clarence H. Mackay Trophy—for most meritorious flight by Army Air Corps personnel during the year.
Collier Trophy—for most meritorious accomplishment in behalf of aviation, the value of which has been demonstrated by actual use.

Move 49th Bombing Squad

In order to better facilitate its training, administration, supply and operation which will result from its concentration with other bombardment units, the 49th Bombardment Squadron has been transferred from Aberdeen Proving Ground, Md., to Langley Field, Va. The unit will proceed to Langley Field with organizational equipment, except such as will be required to properly operate three bombardment and two observation planes at Aberdeen. Orders provide that the following named Air Corps officers, now on duty with the 49th Squadron, and not to exceed ten enlisted men of this unit, will remain at Aberdeen Proving Ground to carry on experimental work and demonstrations in conjunction with the activities at that post: Maj. Fred H. Coleman, First Lieuts. Mark R. Woodward, Wm. H. Bleakley and Second Lieut. George H. Steel.

Army Air Orders

Capt. Russell L. Meredith, Air Corps retired from active service.

Master Serg. Conrad L. O'Briant, Air Corps, Kelly Field, to Havana, Cuba for temporary duty.

Master Serg. Joseph Biando, Air Corps, Kelly Field, to Havana, Cuba for temporary duty.

Maj. Howard C. Davidson, Air Corps, Mitchel Field, to Bolling Field.

First Lieuts. James M. Gillespie, Brooks Field and Jack C. Hodgson, San Antonio, to Havana, Cuba.

Capt. Rosenham Beam, Air Corps, March Field, to temporary duty at Duncan Field. Upon completion of this duty Captain Beam will proceed to Havana, Cuba.

Lieut. Col. Charles H. Danforth, Air Corps, Fort McPherson, to Selfridge Field.

Maj. John N. Reynolds, Air Corps, to Mitchel Field.

The following officers of the Air Corps have been appointed to constitute a board at the materiel division, Wright Field, to judge the design submitted under circular No. 2810, applicable to the development of a primary training plane, and for the purpose of making recommendations to the Secretary of War of the winner or winners of the designs in this competition. They will also make recommendations with regard to the procurement of airplanes to be built in accordance with designs submitted under section "k" and "a" to "i": Maj. Edwin B. Lyon, Washington, D. C.; Capt. Charles B. Oldfield, Brooks Field; First Lieuts. Harry A. Sutton, Barney M. Giles and Eugene L. Eubank, Wright Field.

Capt. St. Clair Streett, Air Corps, Selfridge Field, to Wright Field.

First Lieut. Harry A. Johnson, Air Corps, Wright Field, to Selfridge Field.

Private Horace H. Glenn, Air Corps, Panama Canal Dept., to Pope Field.

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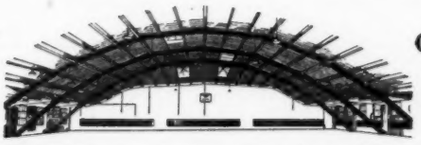

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Index to Advertisers

Advance Aircraft Co. 240
Aerotech, Inc. 286-287
Aircraft Service Directory 286-287-288
Air Transport Equipment 287
American Eagle Aircraft Corp. 277
American School of Aviation 283
American Trading Co. 286
Arch Roof Construction Co. 283
Austin Co., The 273

Barrett Airways, Inc. 280
B.B.T. Corporation 265
Bendix Brake Co. 276
Bennett-Eaglerock Sales Co. 281
Black, Archibald 278
Bohn Aluminum & Brass Corp. 290
Brownback Motor Laboratories 279
Buffalo Aircraft Distributors, Inc. 282
Buhl Aircraft Co. 268

Calumet Air Transport Co., Inc. 286
Cessna Aircraft Co. 291
Cincinnati Aircraft Sales Co., The 273
Classified Advertising 289
Cleveland Pneumatic Tool Co. 278
Consolidated Aircraft Corp. 236
Consolidated Instrument Co. 267
Crawford Airplane Corp. 287
Curtiss Aeroplane & Motor Co. 241

Edo Aircraft Co. 287
Embry-Riddle Co. 287

Fairchild Aviation Co. and Subsidiaries 234
Forged Steel Products Co. 275

G. & O. Mfg. Co. 282
Gates Flying Circus 288
General Electric Co. 274
Gibbons Co. 242
Goodyear Tire & Rubber Co. 237
Guggenheim School of Aeronautics, Daniel 286

Hamilton Aero Mfg. Co. 286
Hanson, C. S. 281
Hartzell Walnut Propeller Co. 288
Haskelite Mfg. Co. 287

Ihling Bros. Everard Co. 281
International College of Aviation 286
Irving Air Chute Co. 282

Johnson Airplane & Supply Co. 270

Kreider-Reisner Aircraft Co., Inc. 287

Loening Aeronautical Engineering Corp. 238
Ludington Flying Service, Inc. 287

Mallette & Son, J. E. 275
Martin Co., The Glenn L. 292
Meyrowitz, Inc., E. B. 287
Monumental Aircraft, Inc. 287
Murison & Cummings 286

National Aeronautic Association 288
Nicholas-Beazley Airplane Co. 277-286

Partridge, Guy V. 280
Perry-Austen Mfg. Co. 279
Pheasant Aircraft Co. 287
Pioneer Instrument Co. 286
Pratt & Whitney Aircraft Co. 263
Prohinsie, Inc., Charles 286

Radio Corporation of America 271
Ryan Aeronautical Corporation 239

Scintilla Magneto Co. 243
Service Steel Co. 278
Shaw & Co., B. Russell 288
Silver-Dixon Co. 279
Southern Airways, Inc. 287
Sperry Gyroscope Company 269
Stearman Aircraft Co. 272
Storms Aviation Co. 286
Stout Metal Airplane Co. 235
Strauss & Buegeleisen 288

Titanine, Inc. 280
Travel Air Mfg. Co. 271

Van Schaack Bros. Chemical Works 283
Vimalert Co., Ltd. 287

Wallace Aero Corp. 287
Where to Fly 284-285
White Dental Mfg. Co., S. S. 276
Wies, Inc., Geo. A. 286
Wright Aeronautical Corp. 244

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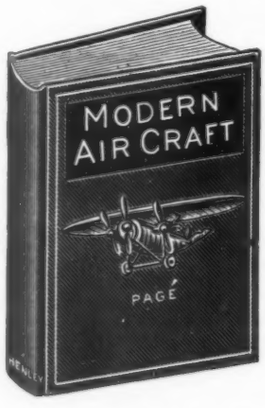

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